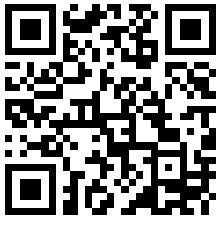
This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google™ books

https://books.google.com

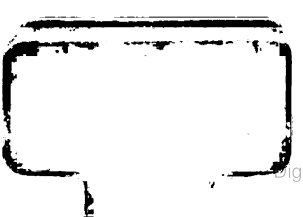


SCHOOLHOUSES AND THEIR EQUIPMENT

NEW YORK STATE EDITION

Digitized by Google

Library
of the
University of Wisconsin
EDUCATION LIBRARY



Digitized by Google

Digitized by Google

Digitized by Google

SCHOOLHOUSES

AND THEIR

EQUIPMENT

With Plans *and* Illustrations *of the*
Newest Schoolhouse Architecture

New York State Edition
1925

by W. W. LaChance *of*

White & LaChance

Architects

Specializing in School Planning
Consulting Service to School Boards

426 Third Street, Carlton Block
Niagara Falls, N. Y.

Digitized by Google

Copyright 1925
by W. W. LaChance

Baker, Jones, Hausauer, Inc.
Buffalo, N.Y.

Digitized by Google

317589
MAY - 4 1927
IK
L13

This copy of

SCHOOLHOUSES
AND THEIR
EQUIPMENT

is *loaned*, and is sent on the understanding that it is subject to recall for revision and for the adding of new material. But—*it is primarily intended for your use, so use it.*

The book when purchased is $5

White & LaChance
Architects
426 Third St., Niagara Falls, N.Y.

Digitized by Google

Digitized by Google

INTRODUCTION

It is not generally desirable to select an architect by means of a competition except in cases of buildings sufficiently expensive to warrant the employment of an architect to outline the terms of the competition and supervise its conduct. An untrained school board will ordinarily secure the best results by selecting a man of known experience and probity who has constructed school buildings of the sort they wish, under conditions the same as will be encountered. Architects submitting sketches in competition, naturally desire their work to be as attractive as possible and, consequently, it is more than likely that the sketches chosen as the most desirable present a building that will cost more than the sum appropriated, or will have to be materially altered and, in the end, perhaps be less desirable than other buildings originally pictured with less pretension.

The author of this pamphlet, specializing in school-designing and equipment, has devoted fourteen years to this particular branch of architecture. During that period he has visited many of the principal schoolhouses in the United States and Canada in quest of the most modern methods of school-designing, and has amassed a considerable library of constructional data that will be of great value to any school board which may have new schoolhouses in contemplation.

For the sake of both the present and future health and safety of the children of your district, your new school should provide adequately for proper lighting, heating, ventilation, prevention of accidents, and sanitary arrangements. All these points cannot by any means be so well covered by a builder or general architect as by one who has made them a matter of very close study and who has had the experience of building scores of schoolhouses of various types.

The public school intimately concerns more people than any other class of edifice, for every citizen avails himself of its privileges in his youth and sends his children to it in later years; and again, its design and construction unquestionably affects, for better or for worse, the health, happiness, and morals of the pupils, whatever may be the effects of education carried on therein. It is, therefore, self-evident when one reflects how long a span of the life of the community is spent within the walls of its schools, that it is all-important to surround the children with the most perfect environment for their hours of study; that these buildings should be the best and most carefully-constructed in the community—not the most splendid and ornate, but the most perfect in design and most complete and thorough in execution and equipment. And one can hardly lay too much stress on the importance of highly-skilled architectural service in the design and construction of our school buildings.

It seems strange that our schoolhouses have been the last public buildings through which public taste has sought to express itself. Adults have

Digitized by Google

regularly thought and planned first for their own needs rather than those of the children; whereas no class of building is deserving of more sincere thoughtfulness and artistic treatment than those designed to accommodate our children. Therefore, when about to build, the safe and businesslike thing to do is to engage the services of architects who devote their whole time to specializing in schoolhouse-designing, and let them work out your ideas.

The planning of our schoolhouses ought to demand, and will demand from any capable and conscientious architect, as painstaking consideration as the largest city school. Upon school boards of towns and cities we would urge with all emphasis that they give their teachers, or at least a committee from the teaching force, a large share in helping to plan their schoolhouses, for it is poor economy to neglect to utilize the teachers' intimate knowledge of special requirements.

Many of the plans illustrated herein have been built from repeatedly and have become "stock plans." They have gone through "the mill," as it were, and any defects in detail have been rectified. These plans and specifications may be purchased from the author in blue-print form for the nominal fee of one per cent based on the estimated cost of the building, and this fee includes all necessary working details.

Every fine building has three leading points: its execution, its magnificence, and its conception. The glory of the first is due to the builder; the second, to the owners; and the third, to the architects.

The services of this office are at your disposal.

Sincerely yours,

W. W. La Chance,

Architect

Digitized by Google

SCHOOL STATISTICS OF THE UNITED STATES, 1922

In 1922 there were enrolled in public elementary and secondary schools, 23,237,009 pupils; and in private elementary and secondary schools, as estimated by the various State Departments of Education, 1,580,837 pupils. The public-school children were housed in 270,574 buildings, of which 175,031 were one-room schools. The total valuation of public-school property for schools of the type mentioned above was $3,008,563,033. During this same year there were expended for sites, schools, buildings and contents, $305,940,965; for other expenses, $389,255,231; making the total expenditures for the year, $1,580,671,296. The total number of consolidated schools at this time was 11,501. There were employed sufficient teachers to fill 705,499 teaching positions, and the average salary of teachers, principals, and supervisors, $1,166 per year. The cost of maintenance for that year is given as $43,754,500. There were 11,284 administrative officers.

NEW YORK STATE STATISTICS, 1921-22

In the State of New York, during 1922, there were 1,823,130 pupils in public elementary and secondary schools. These children were housed in 11,865 buildings. The total operating expenses were $11,201,046; the total value of school property for that year, $354,690,055. There were employed sufficient teachers to fill 58,246 teaching positions. These schools were managed by 201 superintendents of cities and villages for 207 districts, and other superindendents, making a total of 409.

Digitized by Google

IMPROVEMENT OF SCHOOL GROUNDS

The State Department of Education, under date of April, 1, 1916, issued a letter to principals and superintendents (1), to direct the attention of school officials to the importance of initiating a well conceived plan for the systematic improvement and adornment of school grounds, and (2), to outline whereby the desired end could be readily achieved. The State College of Agriculture at Cornell University and the State College at Syracuse University (Forestry Department) both evinced deep interest in this work. Heretofore, they have done much to educate public sentiment and are now giving full assurance of their co-operation. Your school board will greatly assist the State Department of Education by giving them a general description of your school grounds and by stating the amount of money, if any, that can be assured for field work. If no money is available for this purpose, such assistance as may be possible will be freely given through correspondence, suggestive sketches, and other aids. Application should be made to the State Educational Department, through city, village, or district superintendent of schools, as the case may be. This department will supply the necessary information and material for making the preliminary sketches and will in general look after the advance work. When the cases are sufficiently developed, plans for laying out the grounds and for plantings will be prepared in accordance with such arrangements as may be made, and when completed will be returned through this department to the local school authorities. Doubtless, many schools can be well served by home nurseries and dealers, but for the benefit of others it is gratifying to announce that the State College of Forestry, Syracuse, will furnish to the schools, trees and shrubs at actual cost of production plus transportation.

CONDENSED SUMMARY OF REGULATIONS GOVERNING THE APPROVAL OF SCHOOLHOUSE PLANS

(A) SUBMISSION OF PLANS.—The plans and specifications must be submitted in duplicate. After approval by the commissioner of education, one set, officially endorsed, will be sent to the local trustee of board of education; the other set will be filed in the educational department. The set returned is the property of the district, and in a union free school district should be filed with the clerk of education; in a common school district, with the district clerk.

(B) The plans must be submitted on paper not more than 36″ wide, and must show in detail the heating, ventilation and plumbing.

(C) The size of the rooms; length, breadth and height—and the number of individual desks to be placed in the rooms must be indicated.

(D) Prior to approval the following schedule of items must be supplied: (*a*) The name of the town and the number of the district, or the name of the

Digitized by Google

city, the name and address of the trustee, or in a union free school district, the clerk of the board of education. (*b*) an official statement, showing that an appropriation for the construction of the building has been voted by the district or authorized by the municipality, and that the plans have been adopted for use by the trustee or board of education. (*c*) A map of the site, showing its shape and size, the contour of the surface of the ground, the location of trees or other buildings thereon and any adjacent or adjoining properties, together with a block plan of the proposed new building in its proper location. (*d*) Number of cubic feet in the building*; estimated cost per cubic foot; total number of pupils building will accommodate; amount of appropriation.

(E) It shall be the duty of the architect to see that the terms of the general contract and all supplementary contracts are so drawn as to protect the district from any additional expenditures by reason of changes in the plans and specifications that any contractors or subcontractors may make on their own initiative, or that may become necessary effectively to carry out the plans and specifications originally approved.

(F) Specifications must not limit the district to the purchase the goods of any particular manufacturer to the exclusion of products of like quality of other manufacturers.

(G) After the contracts are duly signed, it shall be the duty of the architect to report to the commissioner of education the name or names of the successful bidders and the amount or amounts for which the contracts have been let. Also to furnish a list of all the bidders together with the amount of their respective bids.

(H) Upon the completion of the building, prior to the presentation of his requisition to the local board of education or trustee for final payment for services rendered, the architect shall report to the commissioner of education the following facts: (*a*) Date of completion of building. (*b*) Total cost of building exclusive of site and furniture. (*c*) Cost per cubic foot. (*d*) Cost per pupil accommodated. (*e*) Cost of site. (*f*) Cost of furniture.

(I) Where it is necessary to provide means for the disposal of sewage, the plans therefor must be submitted for approval to the State Department of Health.

(J) Section 451. Plans and specifications of school buildings must be approved by commissioner of education. (1) No schoolhouse shall hereafter be erected, repaired, enlarged or remodeled in a city of the third class, or in a school district, at an expense which exceeds $500 until the plans and specifications therefor shall have been submitted to the commissioner of

*The number of cubic feet of contents must be computed from lowest level or levels of the finished floor, whether first floor, basement, or cellar, to the average height of the roof, calculated from eaves to topmost point, not including ornamental work such as cornices, pilasters, bulkheads, or tank enclosures. Where unusual conditions are encountered in constructing foundations, such as rock excavation, piling, or unusual grade conditions, the cost thereof should be estimated separately.

Digitized by Google

education, and his approval indorsed thereon. Such plans and specifications shall show in detail the heating, ventilation, plumbing, and lighting of such building. (2) The commissioner of education shall not approve the plans for the erection of any school building or addition thereto or remodeling thereof, unless the same shall provide: (*a*) At least fifteen square feet of floor space and two hundred cubic feet of air space for each pupil to be accommodated in each study room or recitation room therein. (*b*) For assuring at least thirty cubic feet of pure air per minute for each pupil. (*c*) The facilities for exhausting the foul or vitiated air therein shall be positive and independent of atmospheric changes.

(K) No tax exceeding the sum of $500, voted by a district meeting or other competent authority in any such city or school district, shall be levied by the trustees until the commissioner of education shall certify that the plans and specifications for the same comply with the provisions of this section.

(L) Halls, doors, stairways, staircases, etc. (1) All schoolhouses, for which plans and detailed statements shall be filed and approved as required by the preceding section, shall have all halls, doors, stairways, seats, passageways and aisles, and all lighting and heating appliances and apparatuses arranged to facilitate egress and afford adequate protection in cases of fire or panic. (2) All exit doors shall open outwardly and, if double doors are used, shall be fastened with movable bolts operated simultaneously by one handle from the inner face of door. (3) No stairway shall be constructed with winders steps in lieu of a platform, but shall be constructed with straight runds, change in direction being made by platforms. No door shall open immediately upon a flight of stairs, but a landing at least the width of the door shall be provided between such stairs and such doorway.

RULES FOR MEASURING SCHOOL BUILDINGS

(M) Standard rules for measuring school buildings have been adopted by two national organizations: The American Institute of Architects and the National Association of School Accounting and Business Officials. The rules will be of value to all boards of education as a means of establishing a uniform system of measurements and cost-finding. For the purpose of obtaining comparable data upon the educational utility and cost of school buildings, they shall be classified, measured, and defined as follows:

(N) Educational Classification of school buildings shall be—Lower Elementary, Upper Elementary, High or Secondary.

(O) Lower Elementary: Shall be defined as a building containing classes and kindergarten rooms, together with the usual accessory rooms, such as principal's office, teachers' rooms, play rooms, toilets, etc., and used for the lower elementary grades only. Should a school building of this type be provided with assembly room, gymnasium or other special rooms, it shall fall into the next classification.

Digitized by Google

(P) Upper Elementary: Shall be defined as a building containing lower or upper elementary grades, and in addition to the regular class and accessory rooms, an assembly hall, gymnasium, and such special rooms as may be included for upper grade or special work, which may include elementary science, elementary industrial training and household arts. This classification would thus include the junior high school, the elementary industrial or other types of special elementary schools.

(Q) High or Secondary: Shall be defined as a building containing recitation rooms, laboratories, and such special rooms as are necessary for classical, technical, commercial, industrial, household arts, normal, agricultural, or other purposes required for secondary or junior college education.

CONSTRUCTION CLASSIFICATION

(R) TYPE A.—Any building constructed entirely of fire-resisting materials, including its roof, windows, doors, floors and finish.

TYPE B.—A building of fire-resisting construction in its walls, floors, stairways and ceilings, but with wood finish, wood or composition floor surface, and wood-roof construction over fire-resisting ceiling.

TYPE C.—A building with masonry walls, fire-resisting corridors and stairways, but with ordinary construction otherwise, i. e., combustible floors, partitions, roof and finish.

TYPE D.—A building with masonry walls, but otherwise ordinary or joist construction and wood finish.

TYPE E.—A frame building constructed with wood above foundation, with or without slate or other semi-fireproof material on roof.

NOTE:—Should buildings of any of the above classification be erected without complete ventilation systems or other mechanical equipment, due note should be made of such fact in reporting its cost data.

COST UNITS

(S) To determine educational utility of the building, obtain the cost per pupil. To determine construction cost of building, obtain the cost per cubic foot. The divisor to be used to determine the cost per pupil shall be determined by the number of pupils normally accommodated in rooms designed for classes only. In arriving at the number of pupils, special rooms are to be figured at the actual number of pupils accommodated for one class period only. Auditorium or assembly rooms are to be ignored, but gymnasiums may be figured for one or two classes, as the accommodation may provide. No gymnasium, however, shall be accredited with two classes if below forty by seventy feet in size. Cost per cubic foot: To obtain the cube of a school building, multiply the area of the outside of the building at the first-floor level by the height of the building six inches below the general

Digitized by Google

basement floor to the mean height of the roof. Parapet walls, stacks and other projections beyond the mean height of the roof, as well as balconies and porches not contributing to the actual usable floor of the building, are to be ignored. Where portions of the building are built to different heights, each portion is to be taken as an individual unit, and the rule applied as above.

COST ITEMS

(T) The cost of school buildings shall be divided into four general items: (1) Cost of land and grading. (2) Cost of building construction. (3) Cost of furniture and fixed equipment. (4) Cost of architects' and engineers', brokers' and supervision services. (1) Cost of land and grading should include the cost of the site and necessary grading to place it in a condition to receive building. Should site be abnormal and require filling, piling, quarrying, or unusual expenditures to place it in normal condition to receive the building, such costs are also to be charged up against the site and not the building. (2) Cost of building should include: (*a*) General contract and any subcontracts pertaining to the general construction of the building, as, for example, excavating, masonry, fireproofing, steel construction, carpentry, cabinet work, sheet-metal work, roofing, painting, etc. (*b*) All contracts for electrical work, plumbing, vacuum cleaning, sewage disposal, heating and ventilation, clock systems, blackboards, elevators or any other contract for any part of the building not included in the above, necessary to complete same ready for occupancy. (*c*) The cost of all site improvements, such as walks, drives, yard-paving, fencing, and landscape-gardening. (3) Cost of furniture and fixed equipment: (*a*) Should include cost of all portable furniture and cabinets, all laboratory and shop equipment, and all other equipment which would not be classified as "Educational Supplies." (*b*) All decorations, including special painting or decoration of any kind that may not be classified under general painting contract. Hangings, rugs, pictures and other forms of decorations furnished at the time of the occupancy of the building which are not classified as "Educational Supplies." (4) Cost of architects', engineers', brokers' and supervision services should include cost of all plans and specifications, architects', engineers, landscape-gardening and supervision, and all other experts' services and expenses.

(U) Economy in Planning.—A well planned schoolhouse, designed economically, should show the following results: The total floor area, taken as 100%, will contain walls and partitions not over 10%; flues not over 5%; accessories not over 3%; instruction not less than 50%; administration not over 12%.

Digitized by Google

SELECTION OF SITE

1 SITE.—The first consideration in selecting a site for a school building is its accessibility. It should be located where the largest number of pupils can reach it most conveniently, and where the adults of the community may make the largest use of it. It is a small matter and of little moment that a few of the children be compelled to walk a little farther than others if a better and larger school ground can be secured. No part of a school site should be within five hundred feet of steam railways or manufacturing plants, livery stables or other buildings which may be a source of unhealthy conditions. There is a reasonableness in the demand for central location, but only when more important demands are not in conflict with it. It is far more important, for example, to have well-drained school grounds, where the opportunity for securing a sanitary water supply and toilet system is good, than it is to give the preference to a location nearer the center of a district where these sanitary necessities are not readily procurable.

2. SIZE OF GROUNDS.—No fixed rule can be made for fixing the proper size of school grounds. Rural schools should have not less than one acre of ground, while high schools require at least three acres. To-day, by reason of the increased number of boys indulging in baseball, football, basketball, track meets and all the open air games that growing boys long for, the school grounds should not be skimped. Athletics in the rural school has had a marked tendency to check the flow of the human tide toward the cities.

3. DIMENSIONS.—The best form for the school grounds, considering shrubbery, grass, walks, play grounds and gardens, is an oblong.

One-acre tracts are ten rods front by sixteen rods deep.

Two-acre tracts, sixteen rods front by twenty rods deep.

Three-acre tracts, sixteen rods front by thirty rods deep.

Four-acre tracts, twenty rods front by thirty rods deep.

4. GROUND AIR.—In selecting a site for a rural schoolhouse the following factors should be considered: No site should be selected that will not offer a good outlet for tile drains set well below the walls of the building to keep the basement and garden in good condition. A wet, swampy piece of land is not only a muddy, dirty place, but it also introduces dangers from ground air and moisture that will always prove troublesome and unwholesome. The air, on account of its great weight, presses into the ground to a much greater depth than is ordinarily supposed. When the air above the ground becomes colder than that in the ground, and this is true at night during warm weather and even during the day during cold weather, the heavy air above the ground will displace that in the ground, and will drive it out at the least point of resistance. Since the ground underneath and about a schoolhouse is drier than that not covered, the ground air is driven from all directions towards the schoolhouse, and by reason of the fact that heat escaping from the building will cause an upward draft, this ground air is easily drawn into the rooms. Ground air contains a far greater percentage of carbon dioxide and other noxious gases than is ordinarily found in air above

Digitized by Google

the ground, these being produced through the agency of the bacteria acting upon decaying animal and vegetable matter in the soil. Moreover, ground air is generally saturated with moisture, and as it rises in the school room, especially at night when the building is cold, will be deposited on the walls, blackboards, and floors, so that all wooden parts of the building are rendered liable to decay, and the air in the building will be stuffy and cellar-like

5. ASPECT.—The point toward which the school should face, should of course be determined by the position of the class rooms, whether placed in the front or back of the building, in order to obtain the most suitable aspect for their windows. During school hours it is essential that every class room should have an abundance of light, and that sunlight should have direct access to every room, at least during some part of the day.

6. SUNLIGHT.—The sun in the early morning and the late afternoon, being then lower in the sky, will naturally shine much farther into the rooms than during the middle of the day. It is, of course, hardly possible to plan that every class room in a large building should have an equally good aspect, but as far as possible it should be arranged that none of the regular class rooms should face the North, excepting in the case of the studio and art rooms, which require steady and diffused light. The advantages of the sun, from the point of view of health, are so great that they should outweigh a small amount of discomfort on a few days of the year.

7. NORTH AND NORTHWEST ASPECT.—These aspects should never be used for class rooms, as they practically get no sun until late in the day. If it is necessary that any of the rooms should have this aspect, let it be those which are occupied seldom or for a short time only. This side of the building could be taken up by the windows of the hall, studio, chemical laboratory, committee rooms, staircases, or corridor.

8. WEST AND SOUTHWEST ASPECT.—These aspects have an advantage in cases where it is preferred to have the direct sunlight into the class rooms at a time when the rooms are not being used, since it is not until the afternoon that the sun will come into these rooms, and they will get hot in summer while missing the early sun in winter.

9. EAST AND SOUTHEAST ASPECT.—Rooms looking to these points get the best light all morning. The sun shines into the room, making it cheerful, bright and comfortable in cold weather, while in summer the sun is off before the hot part of the day. The early sun, too, has not the same power in the morning as later in the afternoon when everything has been heated. In rooms looking due east, the level rays of the sun, except in midsummer, shine right into the farthest corners of the room. For small children, kindergartens especially, this aspect is very valuable. On the whole, perhaps the best aspect a school can have is that from east to southeast.

10. NORTHEAST AND EAST.—For schools where teaching is carried on both morning and afternoon, the sun is off in the morning and in the late hours will shine a very short way into the room. It is always well, especially

Digitized by Google

in arranging exits of a school building, to take careful note of the prevailing wind in the locality, so that the doors should be screened from it.

11. PLAY GROUNDS.—The grounds should, as far as possible, be exposed to the direct sunshine during the school year, to prevent a damp or muddy surface. For this reason it is best to put the building on the west or north side of the school site.

BASEMENT

12. BASEMENT.—Economy and practical sense suggest a basement for boiler and fuel room, fresh-air-gathering chamber and fan room only, with no excavations under main building except for heating and ventilating ducts. Modern schoolhouses are getting away from the basement under the entire building, and in place of class rooms and play rooms occupying the entire area of the building, only such rooms as are absolutely required are now being located in the basement. Modern practice demands that the ground floor be located slightly above the grade line. In high schools it is necessary to have more basement rooms to provide for gymnasium, locker rooms, toilets and manual-training departments.

13. DRAINAGE.—It is important in connection with the foundations of school buildings to see that means are taken to prevent as far as possible the conveying of moisture from the earth through capillary attraction, and the subsequent conditions, "sweating" and cellar-like atmosphere so noticeable when the school is opened in the morning. It is a mistaken idea that if both floor and walls of a basement are thoroughly cemented, no water can get into it. Contrary to the belief of a great many people cement is not impervious to water, and under a comparatively slight pressure water will readily find its way through well-mixed concrete unless waterproofed by some waterproofing compound. Unless, therefore, those who introduce basement floors into school buildings have placed the building on high land, with the ground sloping from it rapidly in all directions, they must encircle it with a drain.

Drainage should be done with ordinary field tile, laid with slightly open joints, having the upper joints covered with a two-inch strip of waterproofed paper or a layer of loose straw about six inches deep before being refilled with earth. The water finds its way into the drain from the bottom of the drain. The gravel, straw or waterproofed strips of paper over the top joints are to prevent the surrounding soil and small gravel entering the tile from the top. This should always be placed a little lower in the ground than the footings, so that the water line will never reach the walls for any length of time. It is never well to run drains under a basement floor, especially if they connect with a sewer. A drain outside will relieve all pressure from surface water. In extreme cases it is proper to place the drain about six or eight feet outside the foundation walls, and then, if the tiles are sufficiently large and the pipes have sufficient fall to its outlet, the rainwater down pipes from the roof can be connected to the drain with hub and spigot tile pipe with cemented joints.

Digitized by Google

14. Damp Course.—There should be a damp course of some suitable material, such as slate set in Portland cement mortar, asphalt, or a coating of plastic cement having a strong bituminous base, or a layer of waterproof paper, bedded in the walls of basement or piers, otherwise dampness will find its way into walls above by capillary action.

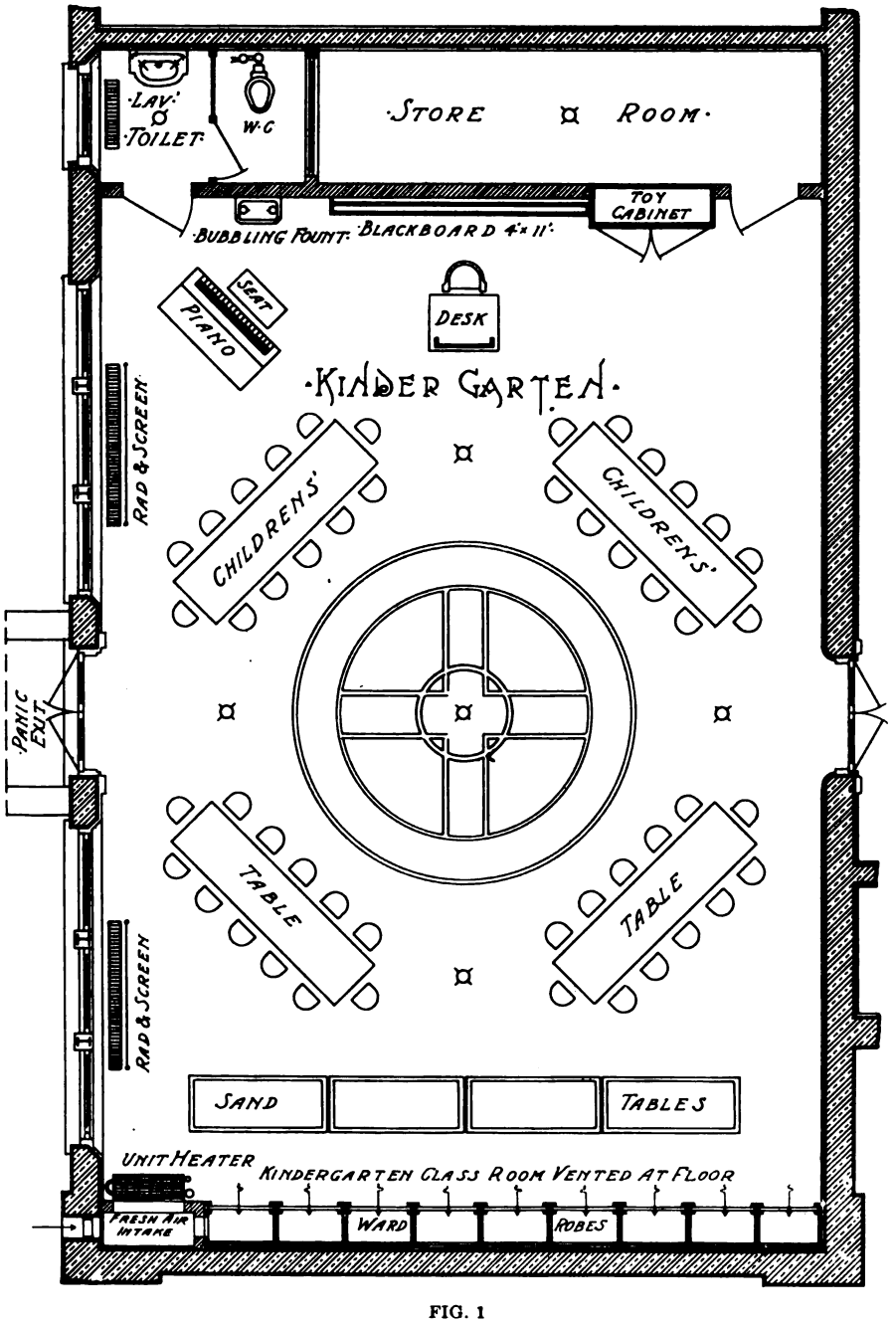


FIG. 1
FLOOR PLAN OF KINDERGARTEN CLASS ROOM

Digitized by Google

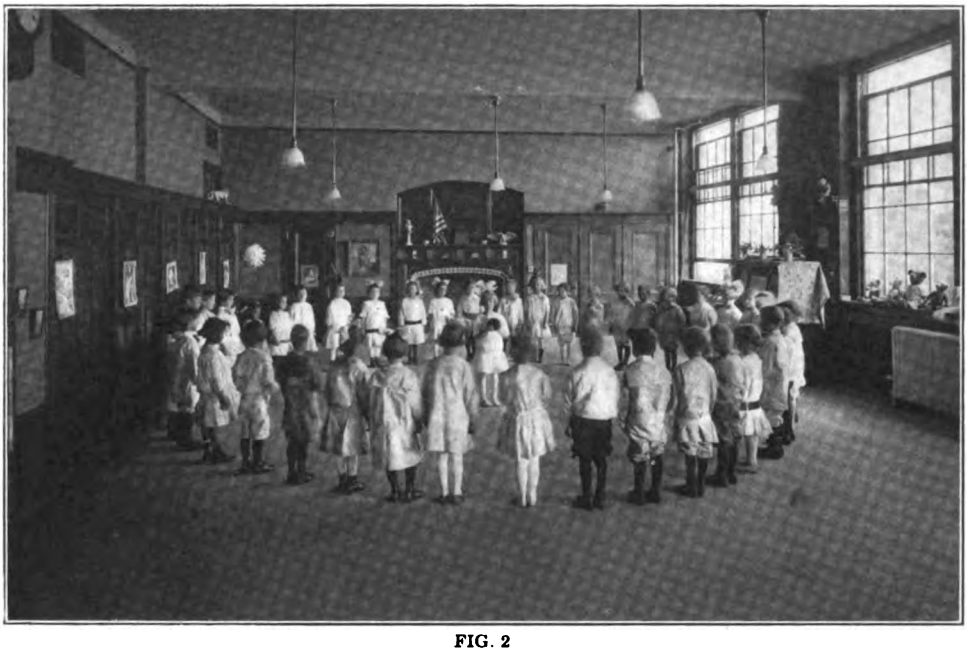


FIG. 2
INTERIOR VIEW OF KINDERGARTEN CLASS ROOM

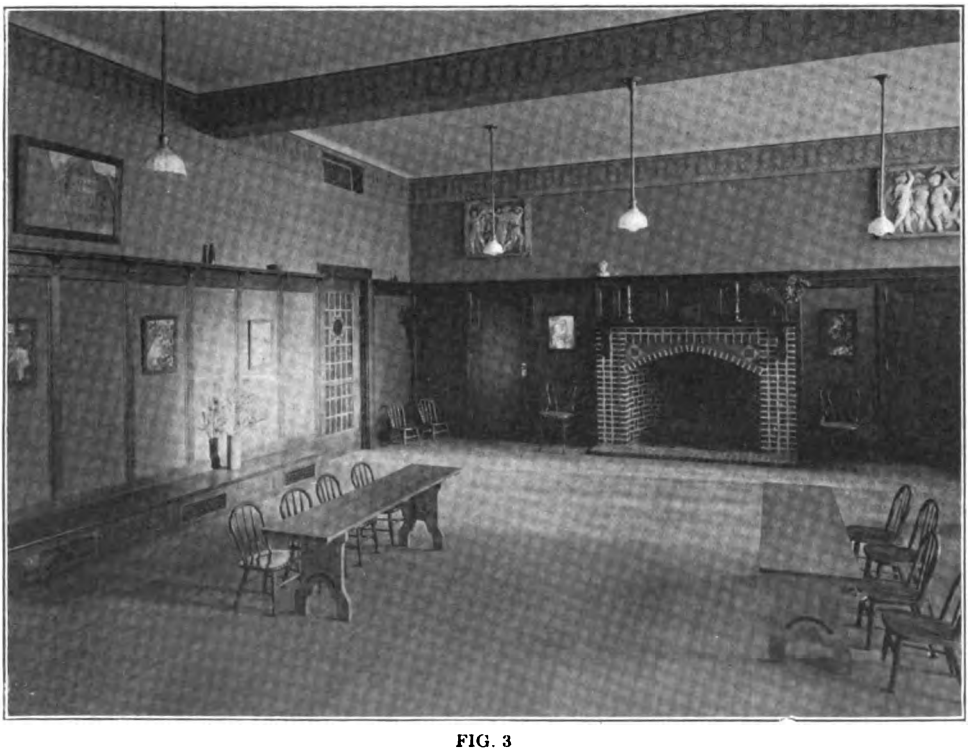


FIG. 3
INTERIOR VIEW OF KINDERGARTEN CLASS ROOM

Digitized by Google

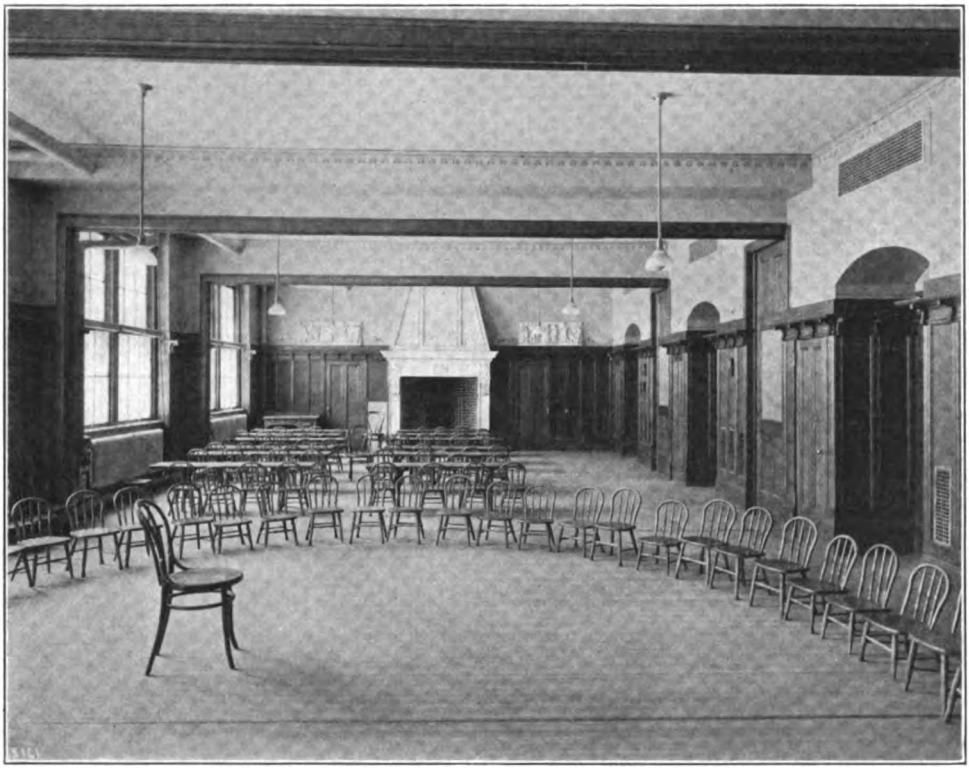


FIG. 4
INTERIOR VIEW OF KINDERGARTEN CLASS ROOM

Digitized by Google

THE CLASS ROOM

15. The Elementary Class Room depends largely on the proper arrangement for its comfort and health. It may be regarded as the main unit of which a school building is composed and to which the other rooms are subsidiary. Department rulings permit but forty pupils in a single room for a rural district, and the minimum floor area per pupil is fifteen square feet and two hundred cubic feet of air per pupil; this, however, should be increased in both cases.

16. FLOOR SPACE.—The minimum floor space of school or class room should be: For primary grades, sixteen to twenty square feet per pupil. All class, recitation and study rooms (not including manual-training or domestic-science rooms) should be at least twelve feet high in the clear. In rural school rooms for less than twenty-nine pupils the height may be eleven feet throughout. While the height of the ceilings mentioned above is less than some authorities recommend, it is a safe and economical standard for elementary schools. One of the objections which will be urged against making the ceilings as low as twelve feet in height is that it will deprive the pupils of air space and make the problem of ventilation more difficult. This objection may be fully answered when it is stated that any air space above twelve feet six inches in height is of no use as regards ventilation, since it remains unaffected by movements of the lower air in the room, nor is it required for light. Further, the pupils need the same amount of fresh air per minute whether they are in a large or small room; consequently, after the initial supply is vitiated, the same amount of fresh air must be introduced in either case. Where forced ventilation is used, the only difference would be supplying a room twelve feet high and one twelve inches higher, and this difference is so small as to be negligible. As an offset to any further comments it might be well to indicate the advantages to be gained by lowering the ceilings and increasing the floor area of class rooms. In the first place, the cost of the buildings should be considered. Every foot saved in the height of the building will reduce the cost much more than a casual calculation would indicate. Every foot added to the height of a class room is an added expense in keeping it in repair, and especially in heating it; also, heavier walls, higher chimneys and vent flues, and longer stairways are required. From the hygienic point of view, there is no special disadvantage for boys, but it is an added hardship on adolescent girls. In case of fire there is also increased danger in high ceilings.

Digitized by Google

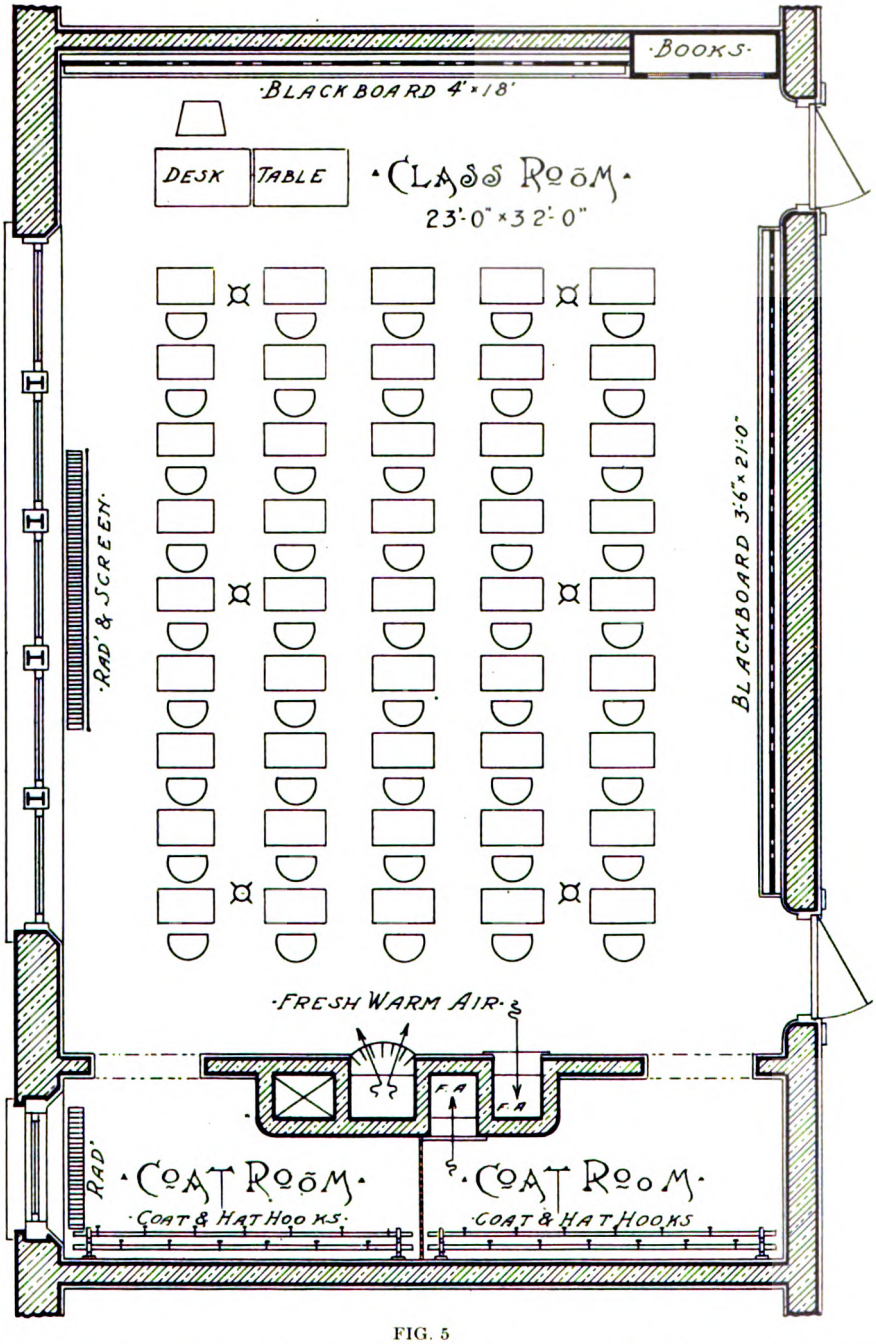


FIG. 5

A FLOOR PLAN OF A MODERN CLASS ROOM, SHOWING COAT ROOMS. NOTE COMPARISON OF FLOOR AREAS OF ILLUSTRATIONS NOS. 5 AND 6, BOTH OF WHICH ARE DELINEATED TO AN EXACT SCALE. FLOOR AREA, 885 SQ. FT.

Digitized by Google

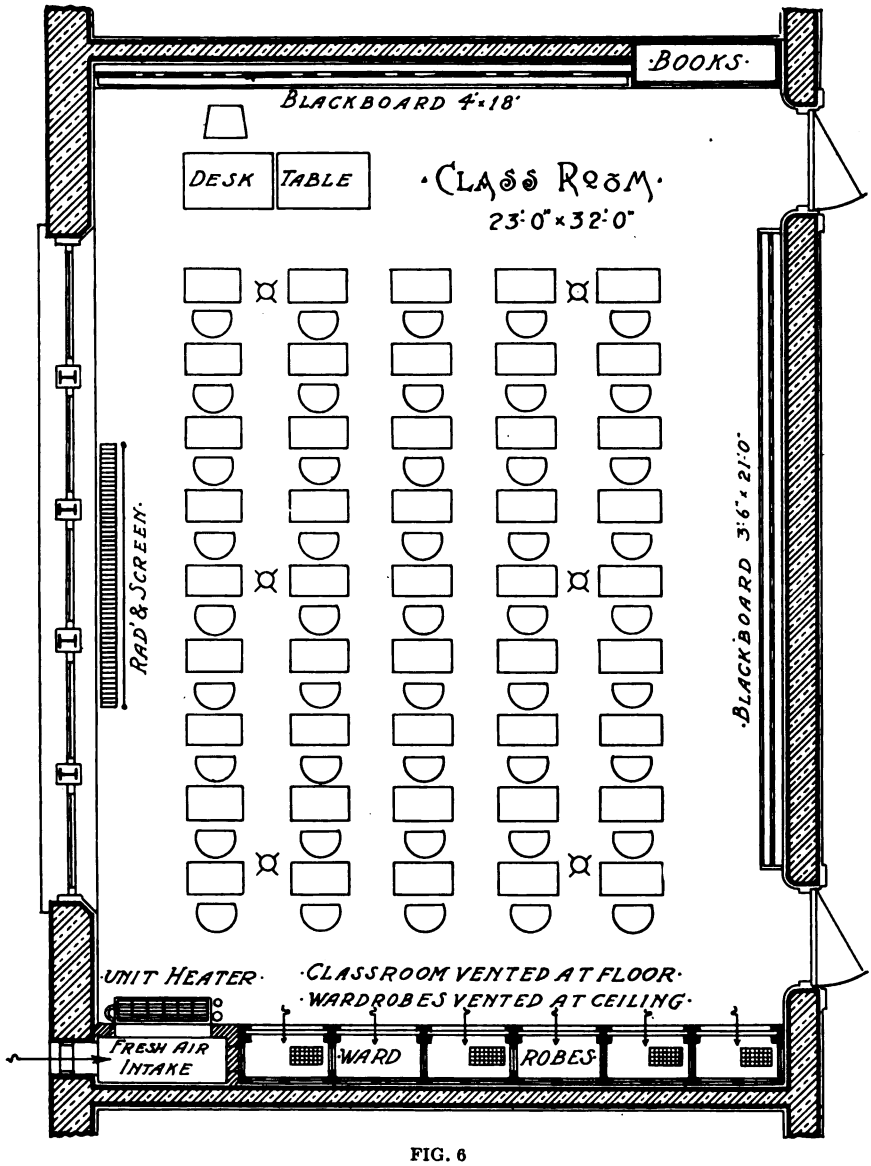


FIG. 6

A FLOOR PLAN OF A MODERN CLASS ROOM, SHOWING WARDROBES. NOTE COMPARISON OF FLOOR AREAS OF ILLUSTRATIONS NOS. 5 AND 6, BOTH OF WHICH ARE DRAWN TO AN EXACT SCALE. FLOOR AREA, 759 SQ. FT.

Digitized by Google

17. Elementary School Rooms.—The standard size of elementary school rooms should be six hundred and thirty square feet of floor area, with a ceiling height of not less than twelve feet. The most satisfactory dimensions of such a room are:—

18. Schedule of Average Sizes of Class Rooms.—

		Rows of desks
For 24 pupils:—19′ x 24′ x 11′-0″		4
For 28 pupils:—19′ x 26′ x 11′-4″		4
For 30 pupils:—23′ x 24′ x 12′-0″		5
For 35 pupils:—23′ x 27′ x 12′-0″		5
For 40 pupils:—23′ x 30′ x 12′-0″		5
For 42 pupils:—23′ x 30′ x 12′-4″	Primary	6
24′ x 28′ x 13′-0″	Grade	6
For 48 pupils:—23′ x 33′ x 12′-8″	Primary	6
24′ x 32′ x 13′-0″	Grade	6

19. Desk Spacing.—Where four or five rows of desks are placed, the above arrangement will permit of desks one foot nine inches wide with aisles between of eighteen inches, having three feet six inches passage along window side. Four foot passage on wall at pupils' blackboard with not less than eight feet clear space at teacher's end and four feet behind rear desks.

Where six rows of desks are placed, the spacing in a room twenty-three feet wide will be as follows:

One foot nine inches width of desk.

One foot four inches space between desks.

Two feet ten inches passage at window side.

Three feet passage at inner wall.

In this latter case it will be seen that the dimensions of passages are somewhat restricted and that a room twenty-four inches wide could be better spaced. In rural schools where room heaters are used some of the desks will necessarily be omitted.

20. Height of Rooms.—No class room shall be less than twelve feet high throughout, except in rural school rooms for less than twenty-nine pupils, where the height may be eleven feet throughout. Rooms partly ceiled on collars should be ten feet high to wall plate, and thirteen feet to ceiling. The flat ceiling should extend over at least half the area of the room. In no case may a class room be left open to the ridge.

These sizes apply to all rooms taught by one teacher. While the height of ceilings is less than that recommended by some authorities, it is a safe and economical standard for elementary schools, especially for rooms above the first floor.

21. Seating Capacity.—The seating capacity of each class room with a twelve-foot ceiling shall be determined by allowing not less than eighteen feet of floor space for each pupil. The above-mentioned size of class room is recommended. However, class rooms having fifteen feet of floor space to each two hundred cubic feet of air space will be approved.

Digitized by Google

SIZE OF SINGLE DESKS

Height of Seat	Back to Front	Across Width	Age Accommodated
12″	21″	19″	5 years to 8
13″	22″	19″	8 years to 12
14″	24″	21″	10 years to 15
15″	26″	21″	12 years to 18
16″	27″	24″	16 years to 20

LIGHTING OF CLASS ROOMS

22. Sunless rooms are apt to be dark and cheerless, and recent experiments seem to show that contagious disease is mostly spread, not by germs flying in the air but by direct carriers such as insects, food, drink, or mucus. Colds seem to be passed from one child to another through minute drops of mucus which are sprayed into the air in coughing or sneezing. The best way to avoid contagion is to flood every corner of the class room with sunshine, and so render these drops sterile. In New York State during the winter season twilight begins comparatively early in the afternoon. Where the shadows are long at noon, and where cloudy, dark days are of frequent occurrence, it is probably a good plan to place the school building half way between the points of the compass, so that all rooms may have sunlight during some part of the day.

23. Light Area Required.—School experts seem to agree that each class room requires an amount of window surface equal to one fourth of the floor area of the class room exclusive of mullions, sash, meeting rails and transoms. To insure efficient lighting of the desks and blackboards by merely supplying the required amount of glass area is not enough. The position of the windows themselves have a great influence upon the complete lighting.

24. Unilateral Lighting.—Most authorities agree that class rooms should be lighted from the left side of the pupil only. With unilateral lighting, it is far easier to arrange for adequate blackboard space and to place it opposite the light. Light from behind the teacher or pupils should under no circumstances be allowed. The glare of the light directly in the faces of pupils will cause discomfort and injury. Where such windows are necessary, this objection may be overcome by using actinic or heat-intercepting glass, as it excludes the injurious infra-red rays and also excludes about 85% of the harmful ultra-violet rays of the sun.

25. Breeze Windows.—It is sometimes deemed expedient to place one or more "breeze windows" high up at the back of the class room for ventilation purposes only, to obtain a through draft, and these should be protected from the direct rays of the sun by the use of actinic glass.

26. Bilateral Lighting.—The question is often asked: Why not have windows on both sides of the class room, for it is not possible to get too much well-diffused light in a class room? Until very recently, school buildings

Digitized by Google

were constructed this way, and it is still very hard to convince some people that lighting from one side only is better than lighting from both sides.

27. Objections to Bilateral Lighting.—Suppose we consider a class room with east and west exposure, with the same number of windows on each side, located in the same relative positions. At ten a. m., the light is stronger from the east than from the west, and the line where the light from each side is equally strong is well toward the west of the room. This will shift towards the east side the rest of the day, reaching the center at noon. But at any time in the day there are always two shadows on the hand and pen. These shadows are of equal intensity only at this shifting line of equal light. To the left or right of this changing line, one shadow is always stronger, and hence it is impossible to seat all pupils so as to give then equally good light for writing. There is no desk in the whole room where double shadows of the hand and pen may not be seen. For this reason it is impossible to seat all the pupils in a class room with bilateral lighting without imposing some slight hardship on all, and a serious hinderance on something less than half of them. There are other reasons why bilateral lighting is not to be preferred. The best place for the blackboard is opposite the source of light, and hence it should be placed on the wall of one side of the class room. A common custom has been to place the blackboards between the windows on both sides. Such a setting has been responsible for an untold amount of eye strain and habits of inattention. It is rational to conclude, then, that if unilateral lighting were not in accordance with the demands of hygiene, it would still be wise to locate all the windows on one side, so that the other may be used for blackboards.

28. Skylighting.—Contrary to the usual belief, light coming from above the desks introduces more disturbing shadows than that coming from the left. For this reason alone, lateral lighting is generally preferable in class rooms to skylighting, though the latter is often helpful in cities where tall buildings obstruct the light, or where troublesome reflections from the outside are likely to overstimulate and fatigue the eyes.

29. Prismatic Glass.—In cases of existing schools where the class rooms are unsatisfactorily lighted, the illumination of the room can be greatly increased by the use of prismatic sheet glass, by means of which the light rays are caught up and thrown horizontally across the room. Care should be exercised to see that the glass is correctly set in position relative to its prisms, so as to get best results.

30. Position of Windows.—In placing the windows it is of great importance, first that there should not be a large space of wall showing between the back of the room and the first window; secondly, that there should be no wide piers between the windows to cast heavy shadows across the room. It is not possible to construct brick, tile or stone piers of sufficient strength in a building of any height that will not interfere considerably with the light. In order to meet these objections successfully, iron mullions may be used, which at the same time will supply sufficient strength and more light.

Digitized by Google

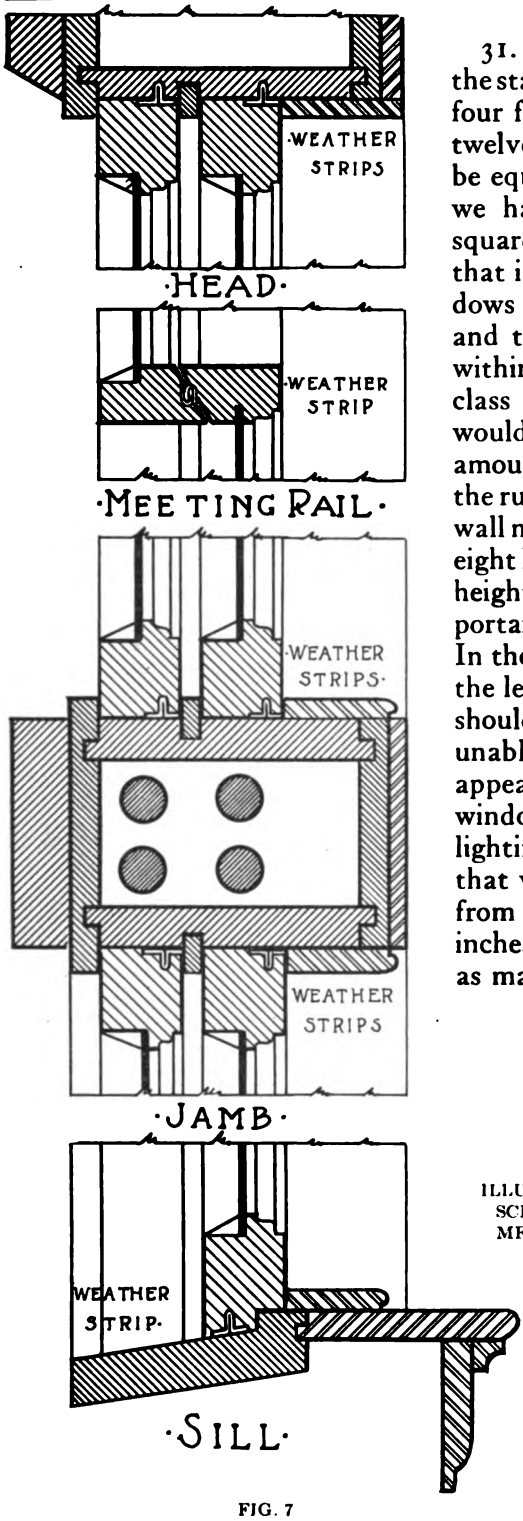


ILLUSTRATION OF CROSS SECTION THROUGH SCHOOLHOUSE WINDOW SHOWING HEAD, MEETING RAIL, PLAN OF MULLION, JAMB, SILL AND WEATHER STRIPPING

FIG. 7

31. WINDOW MULLIONS.—Assuming the standard-size class room to be twenty-four feet wide, thirty-two feet long, and twelve feet in height, the glass area to be equal to one fourth of the floor area, we have one hundred and ninety-two square feet of glass area to place in a wall that is thirty-two feet long. If the windows are set four feet from the floor line, and the tops of the windows extend to within six inches of the ceiling of the class room, the height of the windows would be eight feet. Thus, to get the amount of window surface demanded by the rule, twenty-four feet in length of this wall must be glass. This would leave only eight linear feet of wall space unused. The height of the windowsill plays an important part in the question of lighting. In the first place, it should not be below the level of the tops of the desks, neither should they be so high that children are unable to see out. There is a dreary appearance given to a room where the windowsills are too high, also a loss in lighting. School experts seem to agree that windowsills set three feet six inches from the floor line to three feet nine inches, and four feet, should be regarded as maximum height.

Digitized by Google

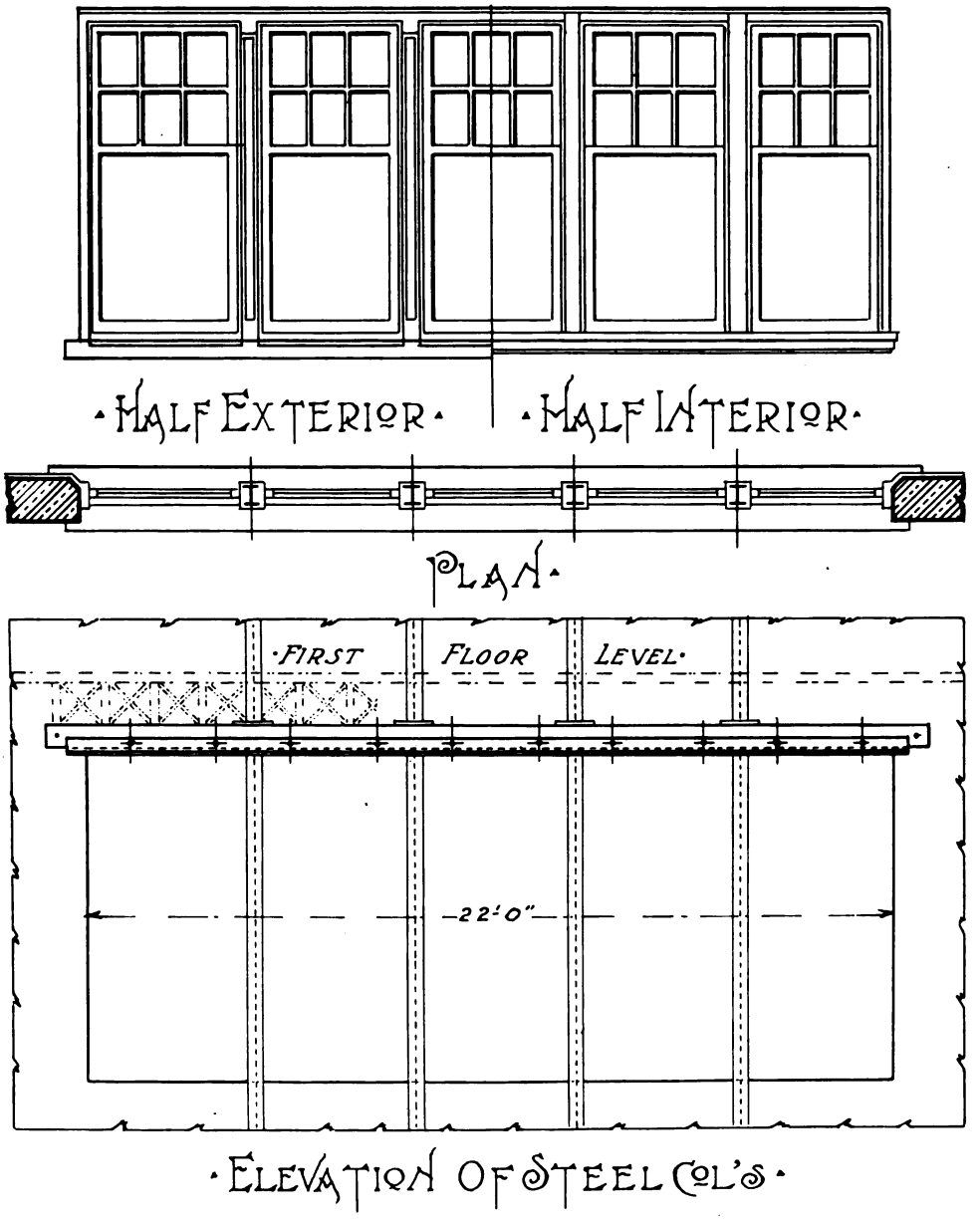


FIG. 8

DETAIL, SHOWING SCHOOLHOUSE CLASS-ROOM WINDOW, DEPICTING ELEVATION OF SASH, PLAN OF MULLIONS, AND ELEVATION OF STEEL FRAMEWORK

Digitized by Google

32. EXPOSED BEAMED CEILINGS.—Exposed beamed ceilings should be omitted in class rooms. They obstruct free circulation of air and form dead-air pockets at the ceiling line.

33. GLARE.—Any brightness that is trying to the eyes—direct sunlight; reflected sunlight that is too bright on window, wall, ceiling or desk; a broad expanse of blue sky; direct passing through translucent shades, etc.

34. BRIGHTNESS CONTRAST.—A patch of sunlight on surface area adjoining a normally-lighted area; a shadow adjoining a normally-lighted area with distinct line of demarkation.

35. SPECIFIC BRIGHTNESS.—A determined condition of brightness. The eye can see better with low specific brightness than with high.

36. QUALITY OF LIGHT.—There is a definite light condition which permits the normal eye to act without strain. To depart from this condition through obtaining more light, less light, or variation in light color, decreases the quality.

37. REFLECTING SURFACES.—All surface areas in the class room—walls, ceilings, floors, tops of desks, pictures, maps, etc.

38. SPECULAR REFLECTION.—Image reflection as from a looking glass; concentrated reflection which reflects in a concentrated and direct manner; reflection from bright surfaces which furnish glare or dazzle.

39. DIFFUSED REFLECTION.—Reflecting in a spread-out manner, so that no image appears, reflecting without glare or dazzle.

With these definitions in mind, the following set rules become intelligible:

Windows should pass a maximum amount of light without the direct rays of the sun or a broad expanse of blue sky appearing. The light so passed should be deflected through a room in a diffused and evenly-distributed manner, so that glare and brightness contrasts do not appear. All reflecting surfaces in the room must cause diffused reflection and not specular reflection, and be finished so that the quality in light color is not lowered, and a specific brightness occurs which permits the eye to act normally and restfully.

With fabric shades, it is impossible to properly regulate or control light. A sufficient and proper light near the window openings means too little light at points farther removed. In other words, a proper and even specific brightness throughout the class room cannot exist.

Again, by covering the entire window area with opaque or semitranslucent shades, in order to cut off the direct rays of the sun so as to avoid strong brightness contrast, too little light is admitted. To allow any of the direct rays to enter through covering only part of the window area with the shade, brings about the condition of strong brightness contrasts, which it is always necessary to eliminate. Translucent shades therefore should never be used, as they always create strong brightness contrasts.

With fabric shades, no matter how the window is placed, light can never enter properly. Light should always come from above down upon the work

Digitized by Google

surface, so that lines of demarkation cannot occur, no matter where one may sit. With fabric shades, all light must either pass horizontally through the room or be reflected from the floor up, to be turned back from the ceiling. These conflicting angles of light cause many lines of demarkation, and necessitate a constant refocusing of the eyes even in the limited space of a book page.

There is only one way to properly daylight a room. There should be at the window a device which will pick up all light that strikes the window-opening and deflect it to the ceiling, from where it is reflected so as to fall evenly, perfectly diffused, throughout the room. In this way, all light is reclaimed and used and not blocked as with fabric shade. In addition to this, perfect ventilation can be secured, and windows may be opened without fear of direct draught and ensuing colds. Such a device, endorsed by the medical profession, is obtainable, so the impossible is not asked.

If the light is thrown to the ceiling, it is evident that this should be a maximum reflecting surface. A proper maximum reflecting surface can be obtained only through using white which must diffuse and not be specular in character, so as not to dazzle. The ceiling, therefore, should be painted (not kalsomined) a dead, flat white. This will furnish a strong white light. Too strong, in fact, unless toned by some neutral light from the side walls. To secure this, all side walls should be painted soft neutral tints, dead flat in finish (this prevents specular glare), which will be pleasing and soothing in appearance. A soft, yellowish green has been shown by scientific tests to be the best color.

40. Window Glass.—Fully 90% of all the window glass is specified by architects as AA quality, while not over 3% of all the window glass produced is of that quality, according to the U. S. Government Master Specifications for Flat Glass. As a result, unscrupulous bidders submit bids on the basis of furnishing AA quality (the highest-priced quality), but furnish A or even B quality, which is much cheaper. A large percentage of the window glass specified as double thick is furnished in single thick, which costs the contractor fully 25% less.

41. Window Construction.—Aside from the wood frame and wood sashes commonly used, of late a new type of window frame and sash is being used in many of our best schoolhouses, this consisting of a rolled-steel construction. Their slender, purposeful lines suggest light and air freedom. With steel windows, the omission of the box-like framing necessary with wood results in a much larger light-giving area and in brighter, sunnier homes. Steel is free from all tendency to warp, shrink and swell with changes in the weather. Of all types of windows made in steel, the out-opening casement offers the highest artistic possibilities. The proportions common with casements are far more pleasing to the eye than the approximate squares into which most double-hung windows are divided; and out-opening casements, when open, agreeably relieve the flatness of the wall as no form of sliding sash can. Moreover, steel is the only really practical material for out-opening

Digitized by Google

casements. Any such casement must sometimes get wet; and repeated wettings weaken the corner joints of a wood casement. Steel casement joints, however, are unaffected by weather. These steel casement windows are of stock sizes and are easily adapted for class-room daylighting. Care must be exercised in selecting any particular type to see that they are close-fitting and have ample provision made for weather-stripping.

42. WEATHER-STRIPPED WINDOWS AND DOORS.—A great saving in coal may be had in school buildings if the windows and doors are protected by metal weather strips. They prevent rattling windows and keep out cold and dust. Where double-hung wood sashes are to be equipped with weather stripping, the sashes are provided with metal strips, one of which fits into sash runway and is made with a three-eighths-inch tongue or raised portion which extends into a groove in the sash. This strip, called the track, is usually made of zinc, but may be made of bronze. The other strip, called the insert, fits into the groove in the sash and is so formed that the spring sides or flanges contact lightly with the raised tongue of the track, and effectually seal the aperture. This strip is usually made of spring bronze, but may be made of zinc. At the meeting rails a flat strip attached to the top rail of the lower sash interlocks with a hook strip attached to the lower rail of the upper sash, positively closing the opening.

BLACKBOARDS

43. BLACKBOARDS.—School work is linked up so closely with blackboard work that the blackboards to be used in school rooms become a matter of first importance. While durability is, of course, an essential requirement, the matter of a smooth writing surface, quick erasing, and the absence of glare are important considerations. In modern school construction there are a variety of methods that can be adopted to obtain good blackboards, but it is not wise to adopt a method that offers less expenditure when a slightly larger expenditure will produce better school work as well as longer service.

44. SLATE BLACKBOARDS.—If it is possible to use slate for blackboards, it should be used, for when carefully set it will prove more satisfactory than any sort of manufactured blackboards. The slate should be free from ribbons or veins. Most slate blackboards are dyed to give them a darker color. Slate comes in various widths from three to four feet, and in lengths not over six feet. Thickness varies from one quarter inch to three eighths inch, and weight is about six pounds for superficial square foot. In placing orders for slate blackboards, school boards should stipulate delivery to be insured against breakages, for this frequently happens, and causes delay and annoyance with railway companies in getting refunds and deliveries.

45. WOOD-FIBER BLACKBOARDS.—There is another preparation which is being used with considerable success, a wood fiber, built up in five plies, laminated together under tremendous pressure, producing a solid, sturdy base, kiln-dried, and coated on the back with an asphaltum preparation to repel any moisture that might come through the outside walls. The surface

Digitized by Google

is composed of a liquid-slating and carborundum, which is harder than steel. The abrasives are applied in various degrees of hardness, so as to have just the right "bite" into chalk for rapid, legible writing. These blackboards cost considerably less than slate, but no more than most composition boards. They come in widths from three feet up to four feet; in lengths from six feet up to sixteen feet; and weigh, when crated, about one pound per superficial square foot. Colors are black and specially-blended green. While black is usually selected by force of habit, yet green has nearly twice the light-reflecting power. The exact percentages are green, 6.2%; black, 3.5%.

46. GLASS BLACKBOARDS.—Glass blackboards are still better, but they are very expensive and it is not likely that they will be used for the ordinary school. They are prepared as follows:

A plate of heavy glass is ground on one side lightly but thoroughly and evenly, and it is slightly roughened on the other side, then this roughened side is painted the exact color the board is to have. By setting the painted side against the wall the color is reflected through the glass to the other side and seems to be an integral part of the structure of the glass. The ground side is the surface upon which the writing will be done. The grinding roughens the glass, which causes the chalk to leave a clear, distinct mark.

47. LIQUID SLATING.—The liquid slating, so called, often put directly upon the plastered walls, may prove fairly satisfactory for a time, but the plastering will soon begin to chip and discolor, and after some usage the board will look spotty and the crayon marks will not leave a clear, distinct impression. In the long run it is usually more economical to use a prepared cement blackboard or a wood-fiber board as previously explained.

48. COLOR OF BLACKBOARDS.—The matter of color has been given considerable attention recently by school authorities. Where a slate blackboard is used, black, of course, is the only color possible, and for that reason black became the accepted color for school boards without much thought being given to the subject. But where a manufactured board is used or a composition material is employed it is, of course, possible to have a color other than black, and dark green is being used and recommended by the manufacturers. Green offers the same contrast to chalk as black, but is much easier on the eyes, resting them where black is liable to cause eye strain. It also adds color and cheerfulness to the school room. The makers of manufactured boards are careful to use a good shade of green, but care should be exercised if a composition material is used and the green is desired. Too much green, or a green in which yellow predominates, should not be used, and care should be taken in preparing the mixture that a dark shade is secured.

49. HEIGHTS OF BLACKBOARDS.—A district school must accommodate the children of all the elementary grades, and hence blackboards must be placed within the reach of the little folk. The mistake of placing blackboards so high that the pupils cannot use them is a very common error, which those who are constructing rural schools should seek to avoid. If the blackboard

Digitized by Google

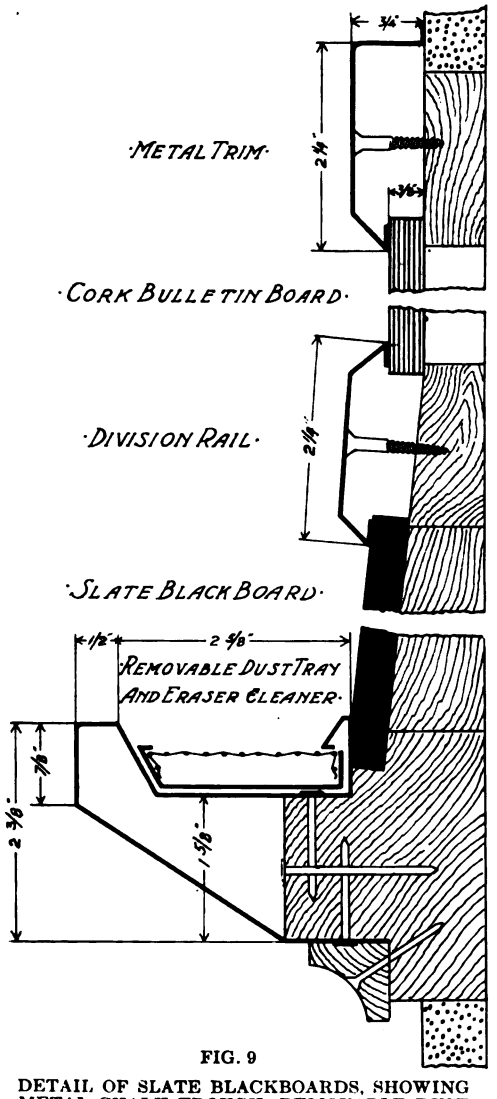


FIG. 9

DETAIL OF SLATE BLACKBOARDS, SHOWING METAL CHALK TROUGH, REMOVABLE DUST TRAY, AND ERASER CLEANER. NOTE HOW BLACKBOARD SLOPES OUT FROM WALL, MAKING IT EASIER TO WRITE FARTHER DOWN THE BOARD

on the wall opposite the windows is set from twenty-four to twenty-six inches from the floor, the little folk will be able to use the lower part to advantage. If a board is three feet six inches wide, the larger pupils will have no difficulty in finding space at the proper height for their work. One cannot do good work on the blackboard in a stooping position, and the work cannot so readily be seen if it is low. The blackboards on the wall back of the teacher's desk will prove more satisfactory if set three feet above the floor and made four feet wide, for this space will be utilized by the teacher for illustrating work and for the assignments she may wish to indicate upon the board. The rear end of the room should also be used for blackboards. The placing of this board may correspond with that at the other end of the room, that is, it should be set three feet above the floor line and it should be four feet wide. The irregular line of the boards will not be disagreeable, despite the opinion of some architects. No blackboard should be placed on the window side of the room. There should be no wall space of any consequence left on the window side upon which blackboards could be placed. There will be no appreciable space between the windows, and in no case should this space be used for a blackboard. It will not receive sufficient light and it will be badly placed with reference to children seated at their desks. Two ends of the room and the side opposite the windows will give enough space for blackboards.

50. CHALK TROUGHS.—Chalk troughs under the blackboards should be wide enough to hold the erasers as well as the chalk, and should be deep enough to hold the chalk dropping from the eraser and the board's surface. If a strip of wire mesh is laid in the trough, it will keep the erasers from

Digitized by Google

gathering the chalk dust in the trough and thence scattering this over the floor. This device will cost but very little and will prove helpful and acceptable. Metal chalk troughs as above are now being manufactured.

51. Exhibition Boards.—Exhibition boards, consisting of twelve inches of cork linoleum (preferably a dark green or brown color) secured by strips, can be placed conveniently along the top of the blackboards.

GRADE	HEIGHT OF CHALK TROUGH New York		HEIGHT OF BLACKBOARD New York		TOP OF BOARD ABOVE FLOOR New York	
Kindergarten	2′ 0″	2′ 2″	4′ 0″	4′ 0″	6′ 0″	6′ 2″
1st, 2d, 3d	2′ 0″	2′ 2″	4′ 0″	4′ 0″	6′ 0″	6′ 2″
4th	2′ 6″	2′ 4″ 2′ 6″	3′ 6″	4′ 0″	6′ 0″	6′ 4″ 6′ 6″
5th, 6th	2′ 6″	2′ 8″	3′ 6″	4′ 0″	6′ 0″	6′ 8″
7th	3′ 0″	2′ 8″	3′ 6″	4′ 0″	6′ 0″	6′ 8″
8th	3′ 0″	2′ 8″	3′ 6″	4′ 0″	6′ 6″	6′ 8″
High Schools	3′ 0″	2′ 8″	3′ 6″	4′ 0″	6′ 6″	6′ 8″

For colleges, it is usual to set the board 3′ 0″ above the floor and use a 4′ 0″ width.

PAINTING AND DECORATING

52. Painting and Its Effects Upon Pupils.—Every color-shade and hue transmits through the eye an effect on the brain. It is therefore of the greatest importance in school buildings where young children and teachers spend several hours each day that the decoration of their surroundings should be most carefully chosen. If scientific attention is given to this subject, the whole morale of the staff and pupils will be improved and, consequently, the general efficiency of the school greatly increased.

Color schemes should be worked out for individual cases, even though similar or standard shades may be adopted. It is, therefore, not possible in this general article to give detailed recommendations. A few points, however, may be of value.

The available light should be distributed to the greatest advantage, so that no strong rays from one direction affect the eyesight. All paints used should be made from non-poisonous ingredients and of the utmost sanitary value. It is a great mistake to apply low-priced water paints which cannot be washed, or lead and oil paints containing poisonous ingredients on the interior walls of school buildings—apart from the fact that both of these paints, as they wear, transmit dust and germs into the atmosphere.

Paints used on walls should always be made washable in order that they may be cleaned or disinfected. Colors should never be harsh or noticeable, but always of soft, delicate shades suited to the lighting, so that a cheerful appearance is given to the room without a noticeable reminder of the color scheme.

Rooms fronting south should be finished in cool green or grey colors. North rooms which do not get the sun, and which may appear cold, should have delicate pink or buff shades and so on, depending on the hours of sunlight in the room. In class rooms, no high gloss paints or varnishes should

Digitized by Google

ever be used, nor should any pattern or stencil work which would distract attention be embodied in the decorative scheme.

School children will mark on the walls as far up as they can reach. It is therefore most necessary where space is not taken up by blackboards to have a good, washable dado around the lower part of the walls for a height of at least five and one half feet.

The great amount of blackboard space used in class rooms tends to absorb much light. On dull days when they are not used it has been found that great relief can be secured by having light shades or curtains which may be lowered over the blackboard. An increase of from 40 to 50% in efficient distribution of light may be had by this arrangement.

Hardwood rather than softwood trim should be used wherever possible in a school, and it is usually an advantage to finish woods in the lighter natural shades with suitable fillers and varnishes.

Basements of schools which are used for recreation purposes, coat rooms, etc., should be carefully dampproofed, as apart from the sanitary value of the dampproofing, a great economy may be achieved in the heating of the building.

Concrete floors should always be made dustproof and hardened, for like sanitary reasons. This can be achieved by a very simple application of waterproofing compound in a liquid form.

ROOFS AND ROOFING

53. The old-time belfry is passing. School buildings without towers or belfries are becoming increasingly common. It gives one a good deal of relief to see that we are slowly getting rid of these useless, impertinent and expensive towers which have for such a long time weighted down many of our school buildings, shocked all artistic natures, and wasted the public money. They are remnants of the time when schools and churches were organically connected, and they remain with us as a reminder of that fact. Generally, they are unsightly, dangerous in time of storms, and expensive beyond all possible need. In country districts and villages this tower has been continued as a belfry, but there is now little need of a schoolmaster regulating the time of a town, and a hand bell or gong will serve all other purposes for which a large bell is now used; but even if a large bell is demanded for merely sentimental reasons it can be placed in some inconspicuous place rather than in an expensive tower which is usually wholly out of harmony with the rest of the building. There are a few architects in our country who occasionally use towers on their school buildings and make them so completely harmonious that they seem in keeping with the structure and are apparently needed, but the day of the tower on school buildings is in its twilight. It is certain that school bells are going out of fashion, and much relief will come when they are forever gone. It would be far more rational and would be more pleasing to the young people of to-day to put the cost of towers and bells into a piano or phonograph for the assembly room. A few buildings with

Digitized by Google

towers are illustrated in the plates, not to show the style of architecture which includes that form of decoration but on account of some special excellence in the design of those buildings in other respects.

54. FLAT ROOFS.—There is in process of development a form of school building, numerously illustrated in this work, which might with propriety be designated a distinctly new type. I refer to that form using a flat roof. This has been developed to meet the desirability of relieving large buildings of a heavy and expensive roof which increases fire risk and demands for support heavy walls thoroughly tied together. In this method of roofing school buildings, the architects have followed the development of business houses. In several cities, these flat roofs have been turned to a novel but very worthy use, aside from protection from the elements. Roof playgrounds have become an important factor in the educational life in large cities.

Practically 90% of all roofing troubles occur in the valleys or flashings, and unless these points of your roof give satisfactory service, roofing troubles and expense are bound to result. Generally speaking, the flat roof which slopes from the side walls to a central point of the building where the rainwater outlet is located has proven a success. Special rainwater outlets provided with screens, flashings and expansion joints are now to be had and are giving excellent results. Where the rainwater is carried off in the center of the building, the rainwater leader never freezes, the heat from the interior of the building being sufficient to keep it always open.

THE LIBRARY

55. Every rural school should have a place for the proper housing of the school library. It should be the aim: First, to make the books easily accessible to all the children. Second, to enable the teacher to exercise close and intelligent supervision. This may be effected in three ways: First, through the use of bookcases with glass doors. Second, through the construction of shallow recesses in a partition wall of the room—a very satisfactory method and a most inexpensive one when building; Third, through the construction of a special room provided either with suitable shelving or bookcases. Such a room should be an alcove of the school without any intervening wall. If this alcove is of sufficient size, a reading table may be provided for the use of the pupils.

56. THE LIBRARY IN HIGH SCHOOLS.—Every class room and department should have its library. Unless the general library is a very large one, or is a community library as well as a school library, a separate room is not necessary, nor is it desirable, unless it is an alcove off the main study room. Experience shows that libraries kept in separate rooms are commonly used to a much less extent than when distributed through the school rooms. It is fundamentally important to have libraries as accessible as possible to both pupils and teachers. In schools where there is a general study room, it is well to keep most of the books for academic grades in that room; otherwise, they

Digitized by Google

should be distributed among the different recitation rooms in accordance with the subjects taught in the various rooms. The books of a general character would naturally be kept in the room in which English is taught. When the main library, because of its size or for other reasons, is kept in a separate room, this room should be adequately lighted, well heated and ventilated, and easily accessible. In that event, the library should be supervised by a regular librarian who has had some training for the work, and should be open the whole or part of each day, as circumstances dictate. The size of the class-room library as well as of the general school library will vary with the enrollment of pupils and the value of the district as a whole; but in general it may be said that in the rural school and in each class room of village or city school, provision should be made for at least two hundred volumes.

57. LOCATION OF THE LIBRARY.—The most satisfactory location for the library is on the first floor, in a central position, accessible to teachers and students, and near the study room. A southern exposure is very desirable. The main requirements in a library are light and sunshine. Where steam or hot water radiators are placed under windows, they leave wall space between the windows for shelving. Every inch of wall space up to seven feet from the floor level is available book space, but it is as well to omit baseboards and chair-rails.

58. WORK ROOM.—This room should be about twenty feet square, equipped with shelving around the walls, a suitable desk or table for pasting, mending, etc., and provided with lavatory and running water. This room is also used for the storing of unbound periodicals.

INFORMATION

(*a*) The maximum allowance for books, apparatus and reproductions of standard works of art for all grades during any one fiscal year beginning July 1st is as follows: to a city, $14 a further sum based on the number of teachers at the rate of $1 each, and a still further sum based on the number of academic departments or high schools at the rate of $150 each; to a union school district maintaining an academic department, $164 and a further sum based on the number of teachers at the rate of $1 each; and to an academy, $150.

(*b*) The library should be made to include in due proportion books of biography, history, description and travel, science, sociology, education, fine arts, poetry, fiction, reference, etc. A disproportionate amount of fiction should be guarded against. Approved periodicals may be included.

(*c*) Singing books, miscellaneous collections offered for sale in sets, great or expensive compilations, complete collections of the works of voluminous authors, unnecessarily expensive editions, fine print and flimsy binding will not be approved; binding should be indicated, if other than cloth.

Digitized by Google

(*d*) Books needed for supplemental reading in class must in the main be supplied by individual pupils or be bought by the local authorities with money raised by an extra appropriation. The duplication of books for any one schoolroom to be paid for in part with State money will be approved only in the case of texts well adapted to work in English. Of such exceptional books, as many as five copies will be allowed to each room for which they are suitable if on explanation the conditions warrant. Duplication involved in placing one copy of any suitable book in each of two or more schoolroom libraries will be approved.

(*e*) On application, the School Libraries Division will advise on the character and the selection of books, and will furnish suggestive lists from which selections may be made.

TEACHERS' PRIVATE ROOMS

59. There should be a room for the private use of the teachers of the staff, of suitable size and comfortably furnished. At least in schools with more than one teacher, private rooms shall always be provided.

The department regulations do not prescribe a private room for a one-teacher school. It is, however, very desirable that one should be provided. Most of our teachers are women, and it is only reasonable that they should have some place where they can make necessary changes or adjustments to their clothing, especially in stormy weather. Such a room is also available in case of the illness of any of the pupils. The slight additional expense of a private room should not deter the trustees from providing one.

COAT ROOMS

60. Four principal systems are used for outer wraps:—(1) A general coat room in either basement or a widened part of the corridors. (2) A coat room for each class room. (3) A room for each sex on each floor connected with the toilet room. (4) Ventilated wardrobes in the class rooms. Any of these forms are satisfactory for upper grades or high-school use, but for lower grades either separate coat rooms adjoining the class rooms, or ventilated wardrobes should be provided. Separate rooms add, it is estimated, about 4% to the cost of the building. This is a recommendation for ventilated wardrobes. They economize space to such an extent that they more than pay for themselves in a total reduction of the cost of building. They also help in school discipline as when installed in the class room the pupils are always under the eye of the teacher who can see that all the small pupils have their wraps on properly before leaving the class room, and that the entering or leaving of the room will not necessarily disturb others. A section of three four-foot unit wardrobes will be sufficient for forty-eight pupils. To this can be added a four-foot unit with book shelves, used as a combined bookcase and teachers' closet. It requires about one hundred seventy-four square feet of floor space for the coat rooms, while a three-foot

Digitized by Google

unit wardrobe requires only twenty-four square feet, making a saving of one hundred fifty square feet; this not only applies to the class rooms but to the basement and roof.

LOCKER ROOMS

61. Locker Rooms.—Locker accommodation for high schools is recognized as an absolute necessity. Students in high schools are moving from one class room to another during the day, and rarely ever finish with a recitation in the same room in which they began the day. They have no permanent class room where they may leave their books and materials. Separate locker rooms should be provided for the sexes, and in large schools there should be two locker rooms on the second floor and two on the first floor.

62. Basement Lockers.—There is no objection to the basement being used for this purpose, provided that basement floor is not more than three feet below the outside grade level, and is well lighted, heated and ventilated. The locker rooms should be near the entrances and so located as to avoid crowding.

63. Individual Lockers.—Where individual lockers are provided, they should be well ventilated, strongly made, provided with shelf and coat hooks and have individual locks with master-key left in the principal's possession. Handles should be flush and the tops slanting and built on the unit principle. This will allow flexibility of installation and change of arrangement at any time. Make these rooms neat and attractive. Then it is the duty of those in authority to see that they are carefully kept. Provision should be made for drying damp clothing, umbrellas and overshoes. The lockers should be raised a few inches off the floor to allow for washing and flushing the floors.

64. Lockers in Corridors.—It is a mistake to place lockers in the corridor; they invite congestion, are hard to keep clean and difficult to ventilate. There is also the objection of the smell of damp clothing, the tracking in of snow or mud and dripping umbrellas. By far the most satisfactory arrangement, but not the cheapest, is to have well-lighted locker rooms for both sexes off the corridors, with toilet rooms adjoining.

CORRIDORS

65. Corridors.—It is a matter of great importance that a corridor should be well lighted in every part, since it serves for a number of purposes besides merely affording access to the class rooms. The corridor should be not less than ten feet wide, in the clear, for buildings with eight class rooms, and should increase one foot in width for every two additional class rooms, and may decrease one foot in width for every two class rooms less than that number. It shall be free from sharp turns. In buildings where the corridors are of fair size, well lighted and heated, there is great opportunity to secure an attractive appearance. It can be used as a picture gallery, for notice boards, etc. Spacious corridors offer perhaps the best opportunity for the

Digitized by Google

location of pictures, for mural paintings and those touches of art which exert such a powerful though silent and unconscious influence upon the lives of young people

In schools where drawing and painting is done, the best work executed during the week may be pinned upon large boards hung in the corridors, providing not only an incentive to work but also a pleasant change of decoration. In high schools the rule is for a complete change of class rooms for all students at the close of each recitation period. This at once makes it clear that the corridors of high school buildings are used much more than those in buildings designed for the elementary schools. Aside from these reasonable and just claims for wide corridors it is always expedient to keep in mind dangers from a blockade in case of fire or panic.

FIG. 10
INTERIOR VIEW OF SCHOOLHOUSE CORRIDOR

FLOORS

66. FLOORS.—There should be double floors in all buildings not of fireproof construction, especially in those situated in the first story. This is important for several reasons, but chiefly to prevent the inflow of ground air and bad odors from basement. The first or rough floor should be carefully filled with well-seasoned material.

Digitized by Google

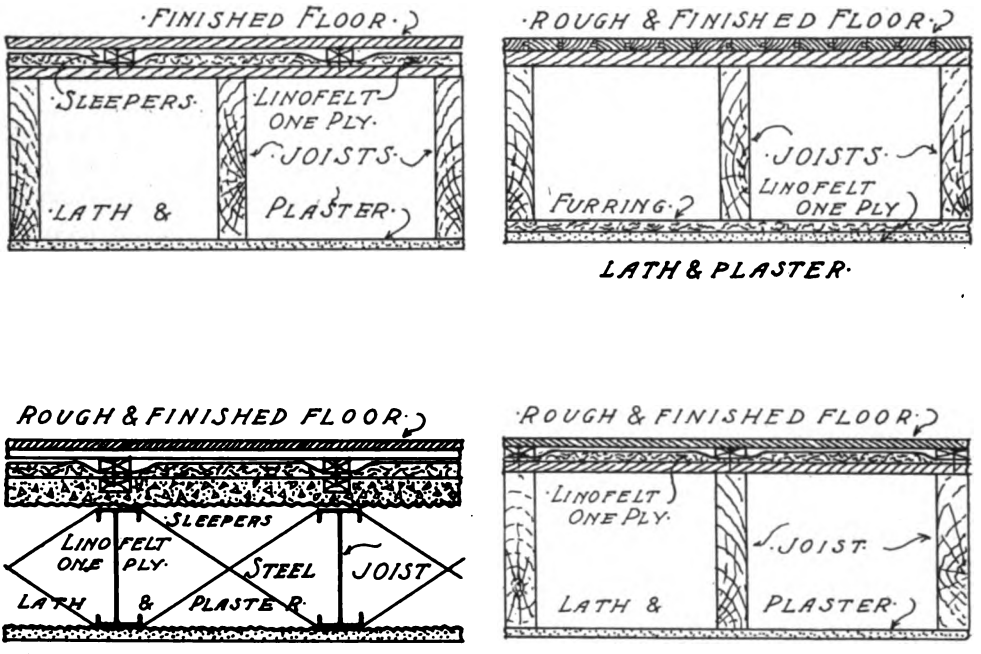


FIG. 11

CROSS SECTIONS THROUGH FLOORS, SHOWING VARIOUS METHODS OF SOUND-DEADENING AND INSULATION

67. Floor Deadening.—Over this should be laid and turned up all around walls, at least four inches in height, some approved sound-deadening quilt. There are many kinds on the market, some composed of seagrass, others of fiber and cattle hair, all designed for this purpose. For small buildings for village or country schools it is far better to use heavy building paper than none at all. Double floors soon save their cost, especially where fuel is high.

68. Double Floors.—From the hygienic point of view, single floors on the first story of a school building should not be tolerated, for during the winter months the children will suffer constantly with cold feet. In the upper story the matter of noise is especially troublesome unless the floors are thoroughly deadened and insured against jarring noises. The problem of the upper floor is therefore a more insistent one than it is for the lower rooms. In buildings thoroughly fireproofed, the problem is easily solved.

To some who are accustomed to conditions as they exist in our cities, this discussion of the need of double floors may seem out of place or at least superfluous, but to all such who read these lines let it be known that there are hundreds of schools built throughout the country with single floors. It is to help prevent a continuance of these errors that the above is written.

69. Hardwood Floors.—For the finished floors, carefully selected hardwood should be well laid with tight joints, the best material being either

Digitized by Google

maple or birch in narrow widths not over two and one quarter inches wide, tongued and grooved, kiln-dried, and not less than three quarters of an inch thick. Such floors wear evenly, do not splinter, and are easily kept clean on account of the close grain of the wood.

70. LAYING OF FLOORS.—Floors, however, are often damaged by careless workmen in their efforts to draw the flooring close together. Instead of using a nail-set or carefully fitting the boards so that they will work together easily, they drive the nails in with a hatchet or hammer, and frequently batter the edge of the boards so that when the floor is completed it will show these marks and leave openings for the entrance of dirt.

71. FINISHING THE FLOOR.—After the floor is laid, it should be planed or sandpapered and when perfectly dry treated with a liberal saturation of wood preservative—two coats—allowing forty-eight hours between coats. The author has demonstrated to his satisfaction that Truscon Wood Floor Preservative, properly applied, covers about four hundred square feet per gallon, two coats, on close-grained wood, and about three hundred square feet per gallon on open-grained wood. The extent of its penetration depends upon the porosity of the particular wood, but it is always sufficient to insure thorough preservation of the treated surface.

72. CORRIDOR FLOORS.—As the floors of corridors in high-school buildings are subject to more wear than those of the class rooms, the material used for these floors is of considerable importance. Where finances will permit, tile, terrazo, composition or linoleum floors with integral bases are clean, nonabsorbent, render the corridor lighter and more cheerful than wood, and are easier to keep clean.

73. COMPOSITION FLOORS.—There are many composition floors on the market, many of which have no prescribed standard, each manufacturer making and maintaining his own. The term, "Composition Flooring," is a very broad one, and great latitude is allowed any manufacturer of this product in making up his formula. The tendency naturally is to produce the cheapest flooring possible. In this way, consideration is usually brought to the cheapest flooring when considered from the viewpoint of price only. Certain adulterations such as sand, infusorial earth, marbledust, ordinary sawdust, etc., are ingredients sometimes offered. A good, monolithic flooring is sanitary, resilient, quiet, and not tiring to the feet. It is warm, being a poor conductor of heat, and is fireproof. There is economy in its use. It costs less than tile and is specially valuable in laboratories and toilet rooms. Being laid in a plastic form, it is easily made an integral part of the base and wainscoting, forming a continuous sheet and many colored combinations can be obtained.

74. ASPHALT MASTIC FLOORING.—Asphalt mastic floors are recommended for play rooms, stair-treads, corridors, and toilet rooms. They are silent, dustless and sanitary.

75. LINOLEUM FLOORS.—Linoleum takes its name from one of its principal ingredients, linseed oil (linum, flax; and oleum, oil). The oil is oxidized

Digitized by Google

by exposing it to the air until it hardens into a tough, rubber-like substance, and is then thoroughly mixed with powdered cork, wood flour, various gums and suitable dry pigments. The resulting plastic mass is pressed on burlap by means of heavy calenders, the exact process varying with different kinds of linoleum. The "green" linoleum then passes into drying buildings called "stoves," where it is cured and seasoned from two to six weeks, depending on the thickness of the material.

Linoleum floors are especially desirable in schools. Unlike rubber tile, linoleum does not "draw" the feet nor make them hot and feverish. Properly installed and cared for, linoleum floors of suitable thickness will wear almost indefinitely, and where laid directly over fireproof concrete base with seams cemented with waterproofed joints and covered with a sanitary cove base are ideal for class rooms, corridors, libraries and stair treads.

Many colored effects and designs are to be had. A brown, gray, or green Battleship linoleum floor will make a pleasing effect.

DOORS

76. Doors.—Taking cost into consideration the most serviceable door for school purposes is that of the "slab" pattern, i. e., five-ply, smooth on both sides, free from mouldings and panels. The center or core built up of light, well-seasoned pine or poplar sections glued together and dried under heavy pressure, then veneered with wood to match finish of rooms. This makes a comparatively light door which will not easily split or warp. Such a door is readily kept clean and when properly finished is more attractive than the regular panel door. In class-room doors it is sometimes desirable to have a glazed panel inserted in the upper part of the door to allow the principal to inspect the class without disturbing the teacher. This has another advantage, it adds light to the corridor.

77. Hollow Metal Doors.—Wherever possible, it is best to use hollow metal doors and metal frames on account of safety and wearing qualities. Such a construction adds but little to the cost of the building and gives a neat finish without heavy casings and is much more sanitary. They are light on the hinges and may be finished with a chemical which is specially designed for fine and lasting qualities in natural wood, or metallic finishes in color to harmonize with any decorative scheme desired. The National Board of Fire Underwriters have tested and approved these doors.

78. Size of Doors.—Modern practice calls for wider openings to school rooms, and from three feet four inches to three feet eight inches are commonly called for. All doors should swing outward from the class rooms in the direction of the exits.

79. Transoms Over Doors.—Are not advisable as they collect dust and do not add to the efficiency of ventilation, they should never be used except for lighting corridors when necessary, and then should be of fixed, non-opening type.

Digitized by Google

HARDWARE

80. HARDWARE.—Double acting spring hinges should not be used, but all outside entrance and exit doors should open outwards, and all inside doors should swing outward toward the natural way of egress. All doors from halls to coat rooms should swing into halls. Single outside entrance doors should have locks so that they may be locked on the outside, but can always be opened on the inside by simply turning the knob whether they are located on the outside or not, the locks being operated by key from the outside only. No night-latch attachment should be placed on the face of lock, or other bolts, hooks, thumbknobs or other locking device used on these doors. Doors from halls and coat rooms should have no locks upon them but should be equipped with knob latches only. However, if locks are desired, the same style as above specified for entrance doors should be used since they can be locked on the hall side, but will always open from coat-room side, whether locked on hall side or not. Locks of this kind are recommended to prevent access from outside, but under no conditions can a person be locked in the building.

81. OUTSIDE DOORS.—Outside doors used exclusively for exit purposes should have one knob latch only, no bolts or hooks, or other locking device being used. One of each pair of outside or inside double doors should have a double-expansion panic bolt, and both should have push bar, push plate, push handle or some other device whereby the simple act of pushing against the same will release the top and bottom bolts and at the same time allow doors to swing open.

Independent top and bottom bolts should not be permitted. The outer door of each pair of outside and inside double doors should have lock or latch as above specified. All bolts, latches, face locks, working parts of extension bolts and other exposed working parts about this hardware should be cast bronze metal to prevent rusting, which would interfere with the operation. Class-room doors should have knob latches (without key) or equivalent. The only doors in the building that may have locks will be the main entrance door, toilet rooms and boiler room.

STAIRWAYS

82. STAIRWAYS.—Should be carefully and properly designed, not more than five feet in width. Stairs should always be in two runs, no winders, and a continuous hand-railing on both sides from story to story, set two feet eight inches from nosings. Such a stairway will enable two files of pupils to go down abreast in perfect order without breaking the line. The location and number of stairways is a matter of great importance, and this is one of the serious weaknesses in a good many of our school buildings, as the number is often reduced in the interest of economy. Stairways should be separated and arranged to serve definite groups of rooms and located for direct lines of travel from class room to stairway. Thus a natural division of pupils is formed and congestion avoided.

Digitized by Google

83. A Closed Balustrade.—Is preferred to the open balustrade or boxed-in type of stair, and under no circumstances should the space under stair-ways be used for storage on account of the increased fire risk. All stair-ways, excepting perhaps those forming the main entrance (which should not extend above the first story), should be enclosed with fire and smokeproof materials throughout, access to the enclosure being made by means of self-acting kalameined doors.

84. Treads and Risers.—For ordinary school use, risers should be not to exceed six and one quarter inches in height with a tread of eleven and one quarter inches. A safe rule is: Tread and riser equal seventeen and one quarter inches, and since anyone coming down stairs usually places the weight of his body on the ball of the foot and the latter on the edge of the step, the treads should, for safety, be slip-proof. There are many safety treads and floor inserts now being manufactured for this purpose.

85. Ramps.—In place of stairways, ramps have been tried in some schoolhouses lately constructed, they are very satisfactory for three reasons: they are easy to keep clean; there is no danger of tripping or falling; they are noiseless. You do not have the stamping up and down stairways and the ensuing disturbance that accompanies noise.

86. Fire Escapes.—All school buildings in the State (except in the City of New York) which are more than two stories high, shall have properly constructed fire escapes on the outside thereof, with suitable doorways leading thereto from each story above the first for use in case of fire. It shall be the duty of the trustees or board of education having charge of said school buildings to cause such fire escapes to be constructed and maintained. It shall be the duty of the principal or other person in charge of every public or private school or educational institute within the State, having more than one hundred pupils, to instruct and train the pupils by means of fire drills, so that in the shortest possible time and without confusion or panic they may be able to leave the school building. Such drills or rapid dismissals shall be held at least once every month. The Spiral Fire Escape has proven a safe method, has been tested under proper conditions, and has shown the following results: Spiral Fire Escape lowered persons to street level in sixteen seconds where it took fifty seconds to walk down the stairs. That while forty-five persons can pass a given point on a stairway in sixty seconds, two hundred persons can easily slide through the Spiral Fire Escape in sixty seconds.

PROPORTION OF TREADS AND RISERS

87. Treads and Risers

Width	Height	Width	Height
8″	7½″	12″	5½″ to 6″
9″	6¾″	13″	5″ to 5½″
10″	6¼″	14″	4½″ to 5″
11″	6″	15″	4″ to 5½″

Digitized by Google

88. HEADWAY REQUIRED.—A headway is required of at least seven feet to seven feet six inches between levels of treads, or six feet three inches to six feet nine inches between raking lines of stair and soffit of landing.

89. GRADIENTS.—Gradients shall be used instead of steps to overcome differences in levels not more than one foot six inches, and no such gradient should exceed one inch in ten feet. Sills of adjacent doors shall be so designed as to be level and flush with adjoining floors.

ASSEMBLY HALL

90. ASSEMBLY HALL.—Every high school building should have an assembly hall. In village and country schools there is as much or more need for an assembly hall as in cities with more pretentious buildings, and yet, under the stress of financial conditions they are very frequently eliminated from the plans for the smaller schools. When we consider the needs of social influences, artistic refinements and neighborhood co-operation movements we must appreciate that an artistic assembly hall will greatly contribute to these ends. While going to press a new law has been passed as follows:

Provision shall be made in plans and specifications for new school buildings so that all the pupils in the school may be accomodated in a general assembly room. Provision shall also be made in such buildings for facilities sufficient far the carrying out the provisions of the physical training law and the rules and regulations of the Board of Regents pursuant thereto.

91. ADVANTAGES OF AN ASSEMBLY HALL.—In the first place, an assembly hall is of special importance in the school itself. The country children will find in an assembly hall the satisfaction of their desire for a wider social contact and companionship. Such a room will also furnish an opportunity for bringing parents together for entertainments, lectures, and community gatherings.

An assembly hall is necessary for the morning exercises, and especially for chorus work. Music is much needed in such schools and, as has been already pointed out, will appeal strongly to young people who have had to leave school. The difficulty of creating a school spirit and a neighborhood enthusiasm for general progress is greatly relieved by an assembly hall. Lecture courses have been introduced by the department of education, not primarily for school children, but rather for those who have left school and gone to work. For such adults as desire to keep up their intellectual interests, manual and technical training, household science and agriculture classes have been formed in support of these branches of education. The department of education has set aside generous grants for those communities who are responsible for schools that will meet with the requirements set forth by the department. In addition to the above uses, it will be a great stimulus to boys and girls if they can occasionally share in the use of these rooms.

An assembly hall, properly and tenaciously guarded against those who have selfish ends to serve, can become the rallying point for the general

Digitized by Google

educational movements of the community. Having said so much in general, these arguments are often needed to convince those in authority of the importance of supplying assembly halls.

92. Location of Assembly Room.—The main use of the room being to rapidly gather together the whole school and then to dismiss the pupils to their respective classes, it is essential that it should be easy of access. The first floor is the logical location. It should be in the center portion of the building rather than at one end of the extremities. In size it should accommodate the entire student capacity of the building.

93. Seating Capacity.—It is important that the seating be arranged so that every seat has an unobstructed view of the stage. The seating capacity may be very closely figured by taking the area of the room (excluding the stage) in square feet, and dividing by six and one half the number of square feet allowed each person. The result will be very nearly the exact seating capacity of the room including the space for aisles. The seats should be spaced at least thirty inches back to back. Thirty-two inches is more comfortable. The width of the seats from arm to arm should be not less than nineteen inches, and twenty inches is more desirable if space affords.

The width and spacing of the aisles are governed in some cities by ordinances, the same applying to theatres. The best practice seems to require that the aisles with seats on both ends must be at least thirty-six inches wide at the narrowest part, and that this increases in width towards the exit at the rate of one and one half inches for every five feet in length. No seat should have more than seven intervening seats between it and the nearest aisle. Obviously, this practice does not permit of more than fifteen continuous seats in a row where there is an aisle on both sides or more than eight seats in a row in an aisle on one side only.

94. Height of Platform.—When the seat aisles have been well arranged it is not necessary to raise the stage high above the audience floor to place the entire stage in view. A comparatively low stage overcomes the awkwardness of making the people in the front rows look directly at the feet of the speaker or holding their heads at an unpleasant angle to see his face. This defect is conspicuously apparent in platforms of many old schools, the stages of which are often four feet high. A height of two feet six inches is quite sufficient. An anteroom on either side should connect with both the stage and corridor.

95. Stage Furniture.—Furniture used on the stage is another item not always given the consideration it deserves. The ordinary school furniture which one usually sees on an auditorium stage is entirely out of keeping with the formal character of a platform, and heavier and larger furniture with a finish in harmony with the color scheme of the room should be selected. Ordinarily, a settee, two arm chairs and two side chairs are all that are necessary. It is also desirable to have at least two tabourettes, or small tables, for flowers, books or other miscellaneous purposes. The reading desk should

Digitized by Google

be of a good design and not of the usual "church" character so often seen. The accompanying illustrations show how good furniture is used.

In front of the curtain to the edge of the stage at least six or eight feet should be available so that when the curtain is closed there will still be sufficient space for the reading table, chairs, etc. Footlights are usually installed in the gutter across the stage front, and when not in use covered with movable board covers. In small buildings, built-in footlights are often omitted and an electric outlet is set in the floor attached to which is a portable footlight.

96. Acoustics.—Acoustics are sometimes a troublesome problem. While it is acknowledged that no positive or absolutely perfect results can be guaranteed, there are, nevertheless, certain general principles which should be kept in mind and followed as closely as possible. In the first place, the room should not be excessively high. In a high room an appreciable length of time elapses between the instant the sound is made and the instant when its reflection from the high ceiling reaches the ear. This produces an echo. The walls and ceilings are better if broken up by ornamentation and projections rather than when they are smooth and plain. A plain, smooth wall, of course, reflects the sound and tends to produce an echo, while one with projections tends to break up the sound waves and overcomes the fault. Comparatively soft plaster, made of the old-fashioned lime mortar, is better than a hard, patent adamant plaster, since it has a tendency to absorb the sound waves while an adamant plaster tends to reflect them.

HIGH-SCHOOL ROOMS

97. High-School Rooms.—In planning high-school buildings, the size of class rooms may vary a great deal to meet the requirements of different-size classes. Some subjects attract relatively small classes, amd it would be useless and expensive to provide rooms larger than required. The class rooms of a high school cannot be standardized in regard to the amount of floor space as can those for elementary purposes. The classes in high schools should not be large, especially in languages and mathematics. In literature and history, more can be accommodated than in other subjects, but even these subjects cannot be successfully taught when the number of students exceeds thirty. A building committee is apt to consider the question well disposed of when sufficient class rooms have been provided to allow a seat for every student. This is based on the calculation and the assumption that each class room is filled instead of upon the number of classes it is intended to have.

It is hardly possible to overrate the advantage to the architect of having the principal give his advice as to what will be required while the plan of the building is under consideration for as soon as one begins to make preliminary studies for high-school purposes, certain definite and peculiar demands arise. Every high school, in addition to the ordinary class rooms, contains laboratories for the sciences, rooms for manual training, agriculture, and household science classes, besides gymnasium, assembly room and locker rooms. It will

Digitized by Google

be in order then to set forth the requirements of a high-school building with reference to special rooms.

The time has passed, in the history of education, when it was thought sufficient in a course in physics for the teacher to set text-book lessons and to do the experimenting himself in the presence of the class. We can have no hope for any lasting interest or thorough understanding of these subjects unless the students take hold of the apparatus and under specific direction and wise guidance perform the experiments themselves. Elsewhere a list is given of the accommodation usually provided in high schools.

98. Assembly Room.—The general rules applying to elementary school rooms should apply to high school study rooms and assembly rooms wherever the floor area of such rooms does not exceed one thousand five hundred square feet. High-school study rooms having a greater floor area than one thousand five hundred square feet and not less than fifteen feet in height, should be computed as having a seating capacity equal to one pupil for every fifteen square feet of floor space. Such rooms should be provided with a sufficient number of doors leading directly to the main corridor in a ratio of one door, not less than three feet wide, to each fifty students or major fraction thereof. Assembly rooms seating five hundred persons or more should

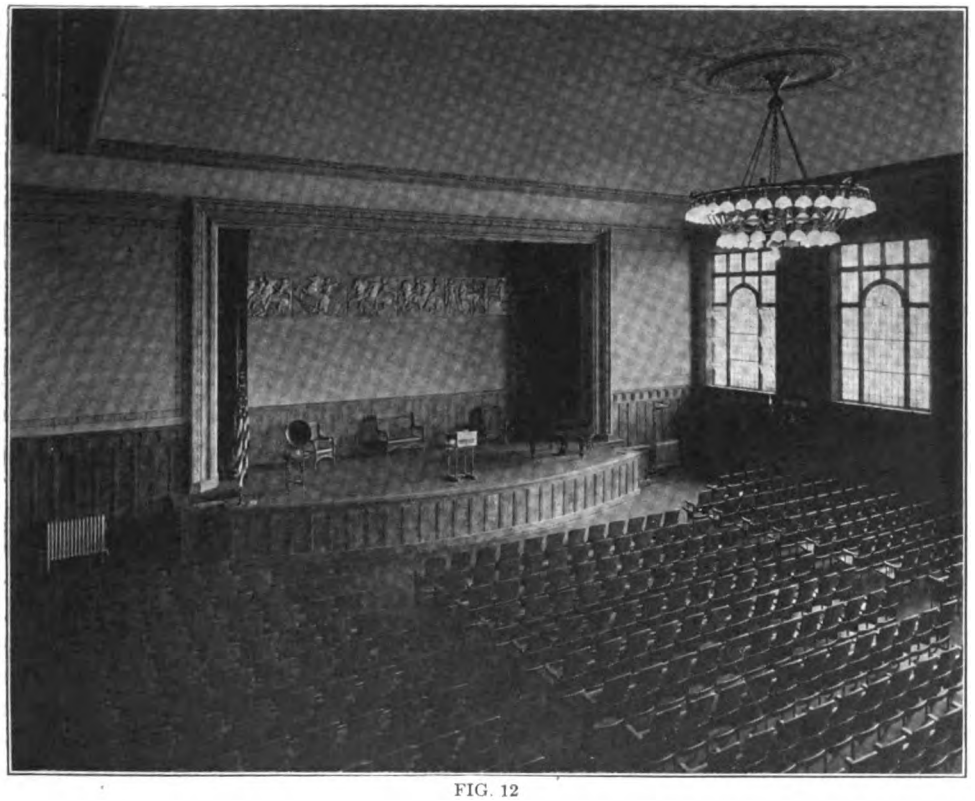


FIG. 12

INTERIOR VIEW OF ASSEMBLY HALL

Digitized by Google

be provided with exits conveniently located and so computed that there should not be less than thirty lineal width of exit for each one hundred persons, or major fraction thereof.

99. RECITATION ROOMS.—Recitation rooms should be oblong and of standard size in regard to floor area and should approximate three hundred and sixty square feet; four hundred and twenty square feet; seven hundred and twenty square feet.

FIG. 13
ILLUSTRATION OF A STUDY HALL

100. THE LABORATORY.—Whether the laboratory in a two-story building should be placed on the first or second floor is an interesting question. There are advantages and disadvantages with either location. The laboratory is a somewhat noisy place, therefore it should never be located between class rooms. It should be as far as possible away from the boilers to be free from disturbing influences on magnetic and electrical experiments. If placed on the first floor there is danger that the fumes and odors from chemicals used in experiments may escape into the corridors and adjoining class rooms,

Digitized by Google

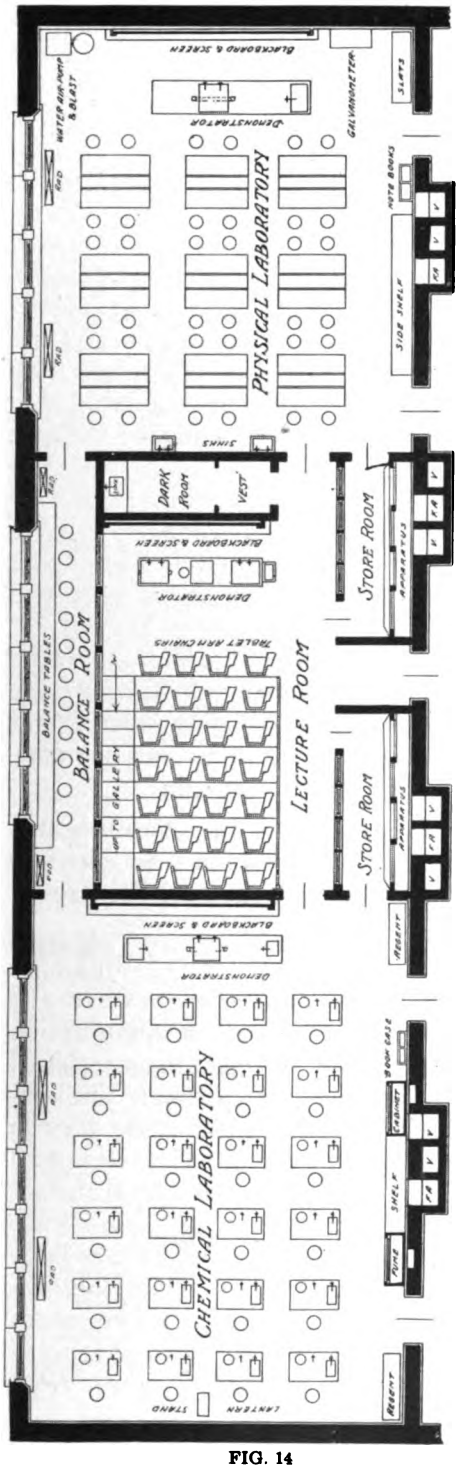


FIG. 14

FLOOR PLAN OF CHEMICAL AND PHYSICAL LABORATORY WITH LECTURE ROOM

making it difficult to keep the air fresh and pure. Then, too, it is better, as far as possible, to use the space on the first floor for recitation rooms, and in this way obviate much stair-climbing. It must be remembered that at least three fourths of the recitations of a high-school course are held in ordinary class rooms. It is far more difficult to properly ventilate a chemical laboratory on the ground floor than it is on the second floor, since, taking it for granted that in the latter location it is next to the roof, all fumes and gases can be more easily carried off. When the laboratory is on the ground floor, ventilation ducts must be placed in the walls, and this makes it necessary either to do the experimenting work close to the walls or to make overhead or underfloor ducts for experimental tables in the center of the room.

On the other hand, it is much easier and less expensive to supply proper and safe plumbing for a chemical laboratory on the ground floor. Aside from the difficulties of plumbing there is no reason why the second floor should not be preferred for the laboratories. The light is better, the probabilities for disturbance are reduced, and it permits of a skylight being used, thus giving more light and ventilation. Laboratories will stand more light than class rooms. A class of twenty-four pupils is the maximum number to be provided for. Assuming that it is best to have the physical and chemical laboratories on the first floor, and if possible in the same part of the

Digitized by Google

building in order to make the lecture room serve both, and not to be removed from the apparatus or supply rooms, the following engraving (Fig. No. 14) will illustrate what seems to be one of the best arrangements thus far worked out.

This engraving shows the laboratories occupying the same wing of a building with windows looking towards the east. They are supposed to be on the top floor, and are adjusted with reference to the apparatus rooms and a common lecture room, lighted with skylight. The balance room is well lighted and is adjacent to both laboratories. These are compactly placed and do not occupy an excessive amount of space. The lecture room is placed between the two laboratories so it may easily be reached by doors from either. After students have finished their experiments in the laboratory they may pass into the lecture room for explanations. The lecture room also has a door into the corridor so that it is accessible from the corridor without interruption from the laboratory classes. There are two store rooms—one for chemistry, the other for physics—with doors leading into respective laboratories. As the apparatus for each laboratory will be continually used for demonstration work in the lecture room, both store rooms have doors into the lecture room as well, so that their apparatus is just as convenient to the lecture room as it is to the laboratory.

The sides of the store rooms adjacent to the lecture room should be made of glass partitions extending to the ceiling, so that the rooms may have good light. The partition between the balance room and lecture room should be of prismatic glass extended to the ceiling, so that the latter will be excellently lighted from lateral windows as well as from the skylight.

101. EQUIPMENT.—It is not the purpose here to enter into detail regarding general arrangement and equipment of the science rooms as scientific progress is so rapid that apart from other questions, no final list can be provided.

102. COMBINATION CHEMISTRY AND PHYSICAL LABORATORY.—In a high school where one teacher is expected to teach both these sciences where the matter of expense is serious and the attendance is small, a combination chemistry and physical laboratory may be used, although the combined laboratory is not to be recommended, for the following reasons: The students' benches suitable for physical experiments are not convenient for the chemistry work. In chemistry, every student should have ready access to a sink, while in the physics bench, the sink is inconvenient; a plain level surface of large area being required. This suggested cutting down is a somewhat distressing subject, but one which for financial reasons usually plays so large a part in the preliminaries of a building scheme, it may perhaps be permissible to lay stress on the fact that cheapness and economy are by no means synonymous terms; a truism obviously, but a factor very likely to be ignored in the effort to bring the cost of the scheme down to some set figure.

Digitized by Google

FIG. 15
INTERIOR VIEW OF LECTURE ROOM

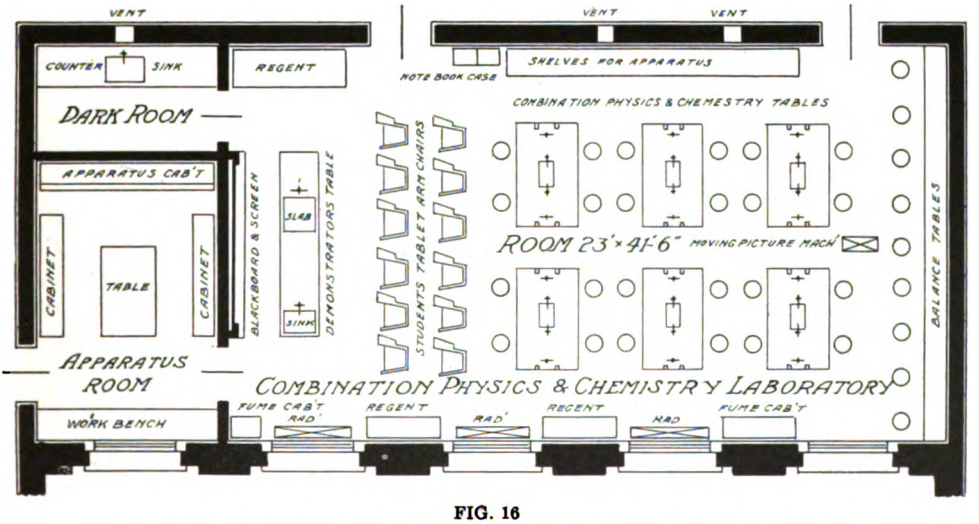


FIG. 16
FLOOR PLAN OF COMBINATION PHYSICS AND CHEMISTRY LABORATORY

Digitized by Google

HOME-MAKING IN THE HIGH SCHOOL

103. The importance of home-making as a part of our public-school program cannot be overemphasized. This type of work will be responsible in a large measure for shaping the lives and characters of the future wives and mothers—the home-makers of the nation. Communities large enough to maintain home-making departments with an enrollment of at least twelve pupils should make provision in new buildings for the development of this type of work. Under the provisions of the New York State Vocational Educational Law, generous provision is made for aiding home-making courses offered in the high schools, evening schools, and in the part-time schools of the State. Under the provisions of the law, the State pays two thirds of the salary of the first teacher and one half of the salary of each additional teacher with a maximum quota of $1,000 on account of the salary of any one teacher.

104. CURRICULUM.—The curriculum for a high-school course in home-making is so organized that girls enrolled for home-making courses take the regular high-school subjects, including four years in English, three years in

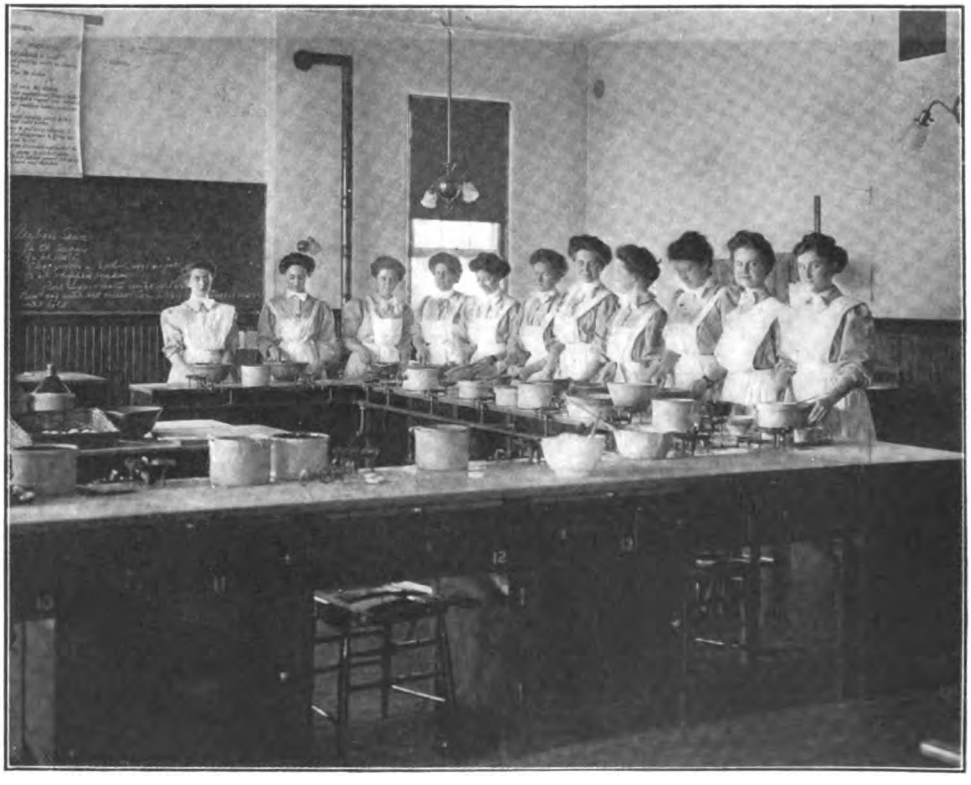


FIG. 17

HOUSEHOLD SCIENCE CLASS ROOM, SHOWING EQUIPMENT

Digitized by Google

FIG. 18
HOUSEHOLD SCIENCE CLASS ROOM, SHOWING EQUIPMENT

FIG. 19
SEWING ROOM

Digitized by Google

science, and two years in history. In addition, each girl is required to spend one double period each day in home-making activities and at least forty-five minutes a day, or its equivalent, to supervise home-project work. The home-project work is planned primarily to enable the girl to put into operation in her own home, under supervision, the principles and practices taught in the school. The development of the home-project work brings the school in active touch with the home and develops a working program that gives the children a maximum degree of training in home-making activities.

105. Room and Equipment.—The number of rooms necessary for the home-making program will depend upon the size of the school and the probable number of girls enrolled for each course. It will be necessary in the smaller communities to make provision for a combination food-and-clothing laboratory. In the larger schools it will be desirable to have separate rooms for food and clothing and to make provision for a lunch room and also for a model apartment. If a model apartment is provided, it is advisable to include a small bed room, small living room, dining room, kitchen and bath room. A lunch room has become a very important factor in the average school. It provides an outlet for the foods prepared in the cooking laboratory and at the same time gives the children an opportunity to buy, prepare and serve

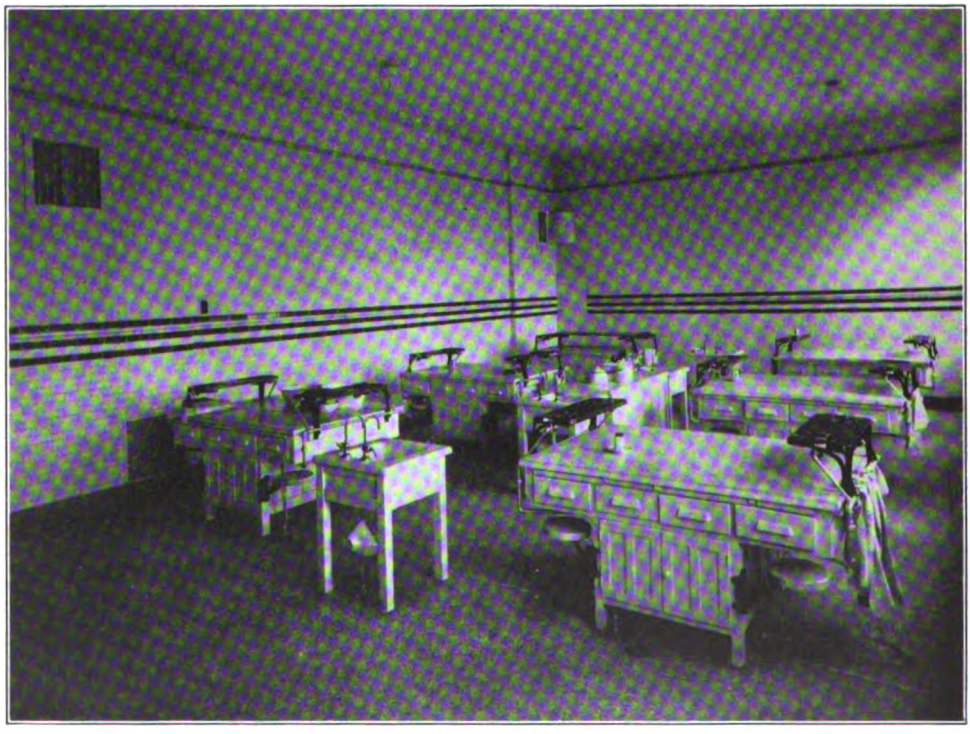


FIG. 20
HOUSEHOLD SCIENCE CLASS ROOM, SHOWING EQUIPMENT

Digitized by Google

foods in large quantities. It also is a very desirable asset to any public school. The type of equipment necessary for home-making courses varies from the very simplest equipment to very elaborate and expensive fixtures. Information in regard to the various types of equipment may be secured from the State Department of Education.

106. It is possible for boards of education to grant to the home-bureau community centers the privilege of using during the summer those public schools which are equipped with home-making equipment and domestic-science kitchens. This means that the women of any community center may have the privilege of using this kitchen for community cooking, canning or other work of a similar nature, by getting in touch with the board of education to arrange for suitable dates.

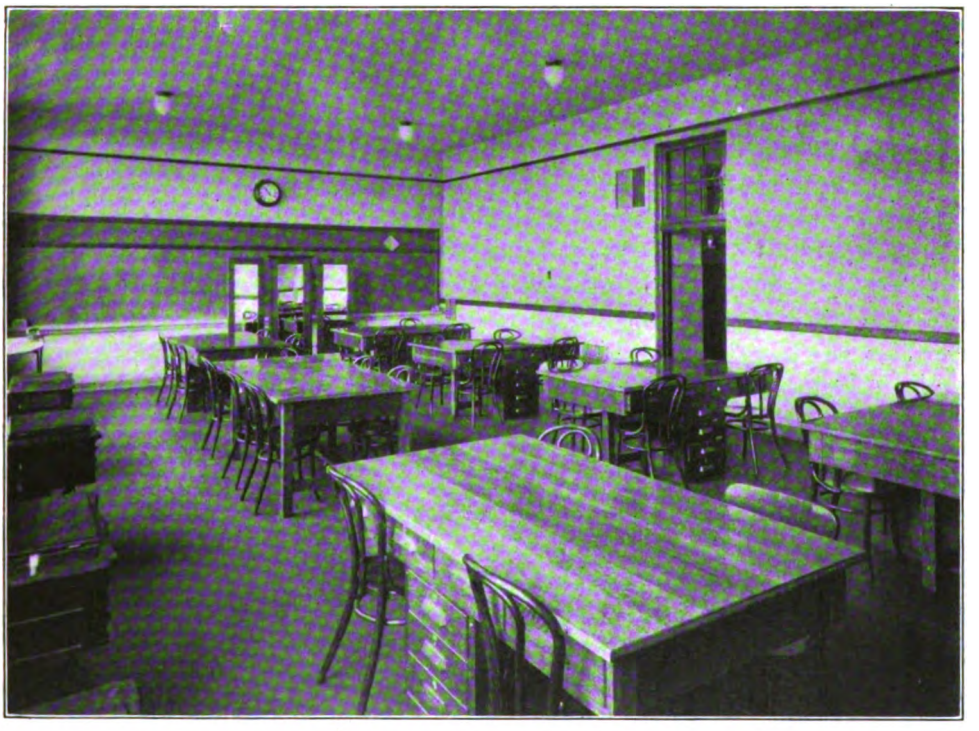


FIG. 21
INTERIOR VIEW OF SEWING ROOM

Digitized by Google

THE GYMNASIUM

107. GYMNASIUM.—No modern school is complete without a gymnasium, and in this connection it may be well to note that there is before the Congress and Senate a bill, known as the "Capper-Fess Bill of Physical Education," which will make physical education compulsory throughout the United States. This will mean that all schools must have a gymnasium. Where funds are not sufficient to provide a distinct department or a separate gymnasium building, architects sometimes incorporate in their plans a combination auditorium-gymnasium. The country boys and girls are beginning to realize that home offers every advantage known to the city youth and gives as well (as added capital) the wonderful effects of a life in the open. It is not boyhood alone that is showing a gain through organized play, the girls, too, are taking to basketball and gymnastic exercises that a well-equipped school permits them to enjoy. The country schools will never be able to do their work properly unless they have also the advantages of those found in the city schools. When consolidation of school districts is taking place throughout the country, the gymnasium should receive careful consideration. Planning a gymnasium requires serious thought if it is to be of real aid, and therefore experts in that line of equipment should always be consulted. There are four departments in connection with the gymnasium, these are classified as "physical activities," they are the gymnasium, locker rooms, baths and swimming pool. The relation of these departments demand that in location and arrangement they be treated as interlocking units.

108. COST OF EQUIPMENT.—A gymnasium of a minimum value (for equipment) of from $1800 to $2000 is obligatory in the case of high schools.

109. SIZE OF GYMNASIUM.—The width should be approximately two thirds of the length. For convenience of arrangement of apparatus, formation of classes and design of running track, this shape serves best. There should be plenty of room provided to allow for a considerable amount of movement. An allowance of from twenty to twenty-five feet per head, counting the largest number that are likely to be using it at any time, is not too large an allowance. The height is of much importance—not less than sixteen feet nor more than twenty-five feet (this refers to the actual ceiling height for overhead apparatus). Where the gymnasium forms only one room in a small school, it becomes impossible to retain sixteen feet ceiling minimum. In such cases, hold as closely to this as conditions will permit.

Good work is done in many gymnasiums where the ceiling height is less, but as a rule it will pay to remodel plans in order to produce the desired height, besides adding many needed cubic feet of oxygen. The placing of the windows must of necessity depend upon general lighting conditions. It may be pointed out, however, that the majority of wall apparatus is attached at points from five feet to eight feet from the floor, chest weights at four feet ten inches and bar stalls at eight feet. These two types of wall apparatus are used in quantities for class work, and allowance should be made for their proper installation. It is desirable to have one good wall, free from

Digitized by Google

windows or windows placed above the height required for apparatus. The various games of ball played in modern gymnasiums make it necessary to protect the windows. Heating pipes require the same thought as windows, and radiators should be set in recesses. Keep the room as free from projecting material as possible. The size may range from the minimum of forty by sixty feet to sixty by ninety feet. Anything less than the minimum would be too small for standard indoor games. The official size for basketball is not less than seventy feet from backboard of one basketball backstop to the other backstop. For ordinary types of class exercise, about forty-five square feet must be allowed to each person exercising.

110. WALLBOARDS.—It will greatly facilitate erection of the apparatus, save expense, and produce better results if wallboards are fitted in walls when construction is going on. They should be set four feet ten inches high on the center for chest weights, and seven feet nine inches on the center for bar stalls. Boards should be one and one-eighth inches and stained to match woodwork.

111. FLOORING.—Maple is preferable for the finished floor. All gymnasiums should have a sub-floor. It must be borne in mind that more or less apparatus is guyed to the floor, which must therefore withstand this upward strain and pull. Many kinds of apparatus are attached to iron plates which are set flush in the floor. If one inch of floor is cut away to insert a three-eighths-inch plate, little is left for screw-hold. A rough floor, one-and-one-quarter-inch thickness, is therefore recommended. The correctly-laid floor follows the lines of the walls. Much of the class drill in a gymnasium calls for marching around the room; and frequently, gymnasiums are used for social events, dancing, etc., in which cases the wearing is more evenly distributed over such a floor, as it follows the grain.

112. STORAGE.—A storage room for horses, bucks, parallel bars and other heavy floor apparatus just off the gymnasium floor at same level with no raised threshold is strongly recommended. It permits of clearing the gymnasium floor for games, class work and exhibitions. The size of the storage room would be governed by the amount of floor apparatus, but the minimum would be three hundred square feet. The door leading from gymnasium to storage room should not be less than five feet in width and six feet six inches in height.

113. PHYSICAL EXAMINATION ROOM.—This should be about ten by twelve feet and accessible only from the physical director's office. A lavatory and private bath in connection with examination room is desirable. This room needs a higher temperature than the gymnasium and office. For all general purposes the following equipment will suffice: weighing scale, stadiometer for standing and sitting measurements, grip dynamometer to test strength of hand and forearm, dunometer to test chest, back and legs, calipers to measure chest depths and shoulder breadths, stethoscope, tape (five-foot line with equalizing spring), wet spirometer to test lung capacity, wall

Digitized by Google

parallels to test the strength of the upper arms, and first-aid cabinets with requisite supplies.

114. Locker Rooms.—The most important consideration in the location of the locker room is the accessibility of the baths. The baths must be entirely separate from the lockers, but close to the baths. (See paragraph 107.)

115. Swimming Pools.—The art of swimming is all-important as a prevention of loss of life and it is recognized as one of the best forms of exercise. The pool should be so constructed as to provide as much light as possible. The shower baths should not be installed in the swimming-pool room, proper. Pools faced with glazed tiles are the best. Swimming lanes marked on the bottom of the pool and distances marked on the sides are advantages for competitive and underwater swimming, etc., these markings being made with black-faced tile. The deepest part of the pool should be eight or ten feet, and it should slope both ways to that point. The deepest part of the pool should be about twelve feet from one end. The shallow end should be three feet six inches to four feet deep. If made too shallow it is a disadvantage for competitive swimming. An overflow should extend around the entire pool. The water should be kept almost to the top of this drain. In usual practice, ten per cent of the pool's contents is flushed once each day by adding water from the bottom, and the entire contents of the pool is

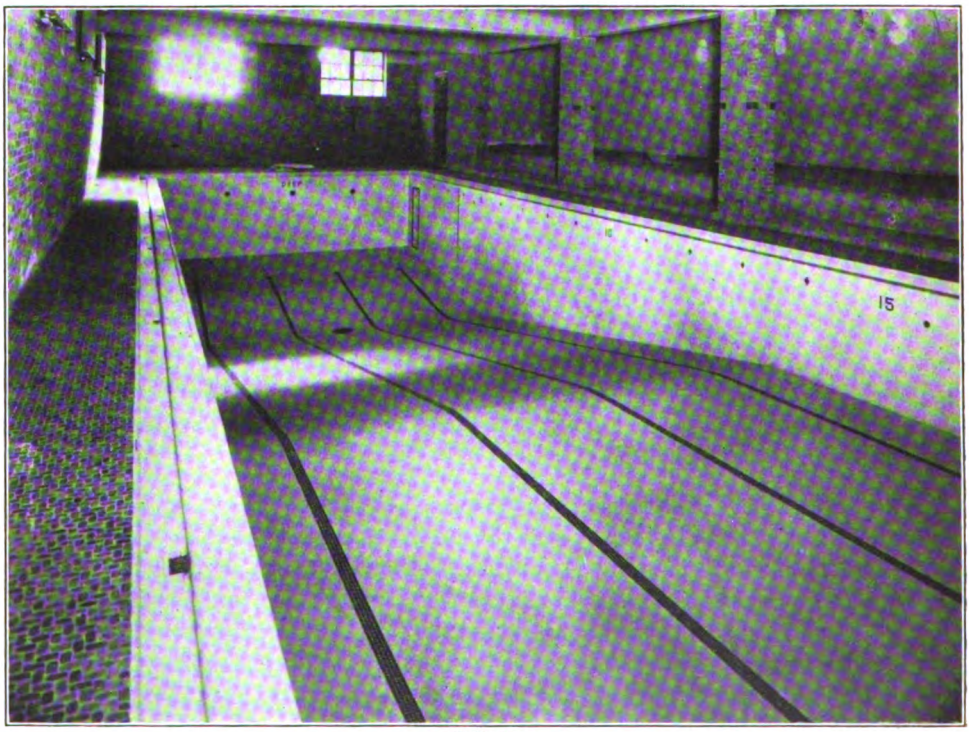


FIG. 22
VIEW, SHOWING SWIMMING POOL

Digitized by Google

usually renewed once a week. Where a refiltration system is used, the water need not be renewed so often. It has been proven by analysis that the purity of the water can be maintained for three or four months where it is constantly refiltered and subjected to the violet-ray treatment. However, in all pools there is usually an accumulation of foreign matter on the bottom of the pool which can best be removed by drainage. There is a cleaner head, consisting of a centrifugal pump and motor which will draw off by suction this foreign matter by passing the cleaner head over the bottom of the pool without removing the water. The size of the pool should range from a minimum of twenty by forty feet to a maximum of thirty by seventy-five feet. The height of the ceiling should be not less than fourteen feet above the water line. Ladders leading into the water should be provided at both deep and shallow ends. Other pool equipment should consist of a diving board only thirteen feet long and twenty inches wide. Anchorage for same should be provided for when building is being erected.

TOILET ACCOMMODATION AND SANITARIES

116. Toilet Accommodation.—Toilet rooms for schools should have as careful consideration as any other part of the buildings. Those in charge of their construction should not lose sight of the fact that there is a moral, physical, and health problem to be considered when installing this part of the school equipment. Toilet rooms should not be located in the basement with supervision only during intermission. A better arrangement is to have toilet rooms located on each floor with sufficient facilities to accommodate the pupils on that floor. This arrangement lessens the stair-climbing and reduces supervision to a minimum. It is always best to set water-closets out from wall, allowing a working space back of them for plumber; this space should be not less than twenty-four inches in width. In order to make the room as light as possible, and at the same time preserve privacy, the windows may be glazed with sheet prismatic glass and protected on the outside with coarse-meshed wire screens.

117. Sanitary Floors.—A few of the newer schools have asphalt floors in the toilet rooms. This is wise because uric acid sets up a chemical action in cement which cannot be corrected, and for this reason cement floors should not be used near water-closets and urinals. There are sanitary floors that may be used to advantage. These are described under the title "floors." If cement floors are used they should be waterproofed. This will render them less porous and prevent the rise of ground air into the room.

118. Walls of Toilet Rooms.—The walls and ceilings of the toilet rooms should be light-colored, so that dirt may easily be seen. If this color is used, there will be less chance of dirt remaining. White-glazed brick or tile, set in cement, make a good wall for a toilet room, as they prevent absorption of light and make it easy to scrub and disinfect the walls. Where walls are so constructed, there is much less liability for defilement in the way of indecent drawings or indelicate writings and scribblings. If cost will not

Digitized by Google

permit of tile or glazed brick being used, composition or waterproofing cement may be used, running up to form a wainscoting. If this is done at the time the floor is laid, to get a cove between floor and wainscoting as an integral part, it will be found advantageous. The floors should be drained to an outlet to allow flushing with water. The boys' floor might drain into urinals.

	BAD	POOR	FAIR	GOOD	BEST
SQUARE FEET OF FLOOR SPACE FOR EACH PUPIL		12	14	16	18
CUBIC FEET OF AIR SPACE FOR EACH PUPIL		170	190	230	260
PERCENTAGE OF WINDOW AREA FOR EACH PUPIL		10	15	20	25
SQUARE FEET OF PLAYGROUND FOR EACH PUPIL		20	35	50	65
NUMBER OF BOYS TO EACH URINAL		35	45	35	25
NUMBER OF GIRLS TO EACH TOILET SEAT		50	40	30	20
NUMBER OF BOYS TO EACH TOILET SEAT		30	24	18	12
NUMBER OF PUPILS TO EACH DRINKING FOUNTAIN		130	100	70	40

FIG. 23

TABLE, SHOWING STANDARD FOR JUDGING SCHOOLHOUSE ACCOMMODATION. COMPARE IT WITH YOUR OWN SCHOOLHOUSE

Digitized by Google

119. WATER-CLOSETS.—Water-closets should be of vitreous china with open-front seats of sanitary material such as "Whalebonite." They should be self-operating by means of a self-acting valve to flush the bowl. Some architects recommend integral seat and bowl, claiming that they are easily kept clean; these have no sanitary wooden seats. On the other hand, it has been found that the integral bowl is cold and uncomfortable, and on this account tends to retard the movement of the bowel. Provision should be made for different sizes of seats for primary children. The number of toilet fixtures to be installed should be not less than one seat for each fifteen to twenty girls, and one seat and one urinal for each twenty-five to thirty boys. Teachers should have separate toilet rooms and lavatories. If rest rooms are provided ,the toilet and lavatory can be arranged adjacent to this room. The toilet and lavatory for the superintendent and the principal should be arranged adjacent to their offices. When constructing the building it is best to keep in mind that the toilet rooms will be among the best rooms in the building and the fixtures will be of the best type and make. The toilet rooms should be thoroughly ventilated with a ventilating stack entirely separate from the other ventilating apparatus of the building. In school buildings having provision for mechanical ventilation, the toilet rooms should be connected with an exhaust fan. There should be such a pressure on the toilet rooms at all times that the air will not pass from the toilet rooms to the corridor when doors are open.

120. DRINKING FOUNTAINS.—In selecting drinking fountains, care should be taken to see that an automatic-controlled fixture is adopted. In schoolhouses, the periods when drinking fountains are used cause a heavy demand on the water line which results in a material variation in it. When the line-pressure varies, a momentary decrease either puts the ordinary drinking fountains out of use or, if regulated to meet the low-line pressure, an increase in pressure throws the water out of the bowl. There is a drinking fountain on the market, "Halsey Taylor Stream Control," which is adapted for use on all pressures ranging between fifteen and two hundred pounds, and it takes care of a variation up to fifty pounds. Regardless of the pressure variation, the fountains give a steady stream—never too high, never too low Drinking fountains should not be located in the toilet rooms. They should be outside in the corridor. This will separate the pupils into groups and lessen the tendency towards loitering and confusion.

121. SAND STRAINERS.—For the protection of plumbing fixtures,meters, etc., from scale, cuttings, sand, shells and other foreign matter, sand strainers are recommended. They also prevent cutting matter reaching the working parts of the water-pressure regulator and should be used wherever a regulator is installed. They are not expensive.

122. URINALS.—Individual urinal stalls are very unsatisfactory in elementary schools. It is almost impossible to flush them thoroughly, to keep clean, and to properly ventilate.

Digitized by Google

123. HIGH-SCHOOL TOILETS.—Toilet rooms in a high school should be distributed throughout the building, with boys' and girls' toilets on each floor. That is because the toilets are used particularly during the change in classes, and should be easily accessible. This is a somewhat different arrangement from elementary schools, where the toilets are most used during recess time.

124. TOILET PARTITIONS.—With the advent of steel toilet-partitions' doors, back and utility-corridor enclosures a highly satisfactory solution of the question of suitable partitions for this purpose has been solved. This product, built of sheet-steel metal throughout, fulfills every requirement of the modern toilet room, being fireproof, sanitary and inexpensive when compared with marble or slate, and being of metal construction throughout there are no unsightly joints and nothing to crak, warp or swell. This product adapts itself in every way to meet all ordinary as well as unusual conditions in connection with toilet, shower and dressing-room enclosures.

THE INCINERATOR

125. THE INCINERATOR.—Perhaps in no other building, with the exception of hospitals, is the immediate, complete and sanitary disposal of promiscuous waste as important as in schools. Where so many children are housed under one roof, sanitary conditions must be kept as near perfect as possible. We believe incineration to be the solution of this problem. There is an incinerator on the market which has been in use for many years in schools as well as residences and apartments throughout the country. It consists of a firebrick combustion chamber in the basement with hopper doors located in the flue on the floors above. Into this hopper is deposited all waste, including garbage from the cafeteria (if there is one), wastepaper, sweepings and sanitaries; in fact, anything that is to be thrown away. This waste falls to the incinerator in the basement. From time to time the material is lighted and it all burns to dry ashes. The supply of dry, combustible waste is ample to dry out and consume the wet waste. The refuse itself is fuel for its own destruction; consequently, it costs nothing to operate. Collections of wastepaper in the basement are dangerous fire hazards, sanitaries are likely to clog the plumbing, and garbage is always a nuisance. The incinerator eliminates all waste without a penny of operating expense. The cost of installation is trifling. High schools in all cases should be equipped with an incinerator.

TOILET FACILITIES

126. OUTDOOR CLOSETS.—It is fundamentally important that all schools in cities, villages and country be provided with suitable toilet facilities. They cannot be suitable unless they are sanitary, and experience has demonstrated beyond the possibliity of contradiction that the old type of outdoor toilets or earth closet is not sanitary or decent, but to the contrary is a constant menace to health and morals. As every boy and girl under the

Digitized by Google

tutelage of the State is entitled alike to all essential safeguards, this statement necessarily applies to all schools regardless of the size or location. The claim that the old type of outdoor closet has served all purposes of the district for generations, and is therefore acceptable and suitable, is without weight. To the contrary, experience with it in the past conclusively proves that it is wholly unfit and unsatisfactory. The public school surely ought not to be the last institution to make progress, and particularly in matters affecting the comfort, health and lives of the children who, obedient to the laws of the State, are in attendance therein. We know that typhoid is a germ disease, and that unsanitary toilets, through the agency of flies and infected water, are among the chief means of spreading this disease in cold weather as well as in warm weather. Where absolute cleanliness in this regard prevails, typhoid fever generally disappears. Considered merely from the economic point of view, the costs each year for typhoid fever cases would go a long way towards paying for the construction of sanitary and decent toilets.

127. REGULATIONS.—From what has been said, it is manifest that the only solution of the outdoor-closet problem is to abolish them. With this end in view, and to insure in their places suitable and adequate facilities, the following regulations have been adopted:

(1) Approval of plans for the construction of new school buildings and for the remodeling of old buildings cannot be given until provision is made for an approved system of sanitary closets.

(2) All public schools must be provided with approved closet facilities before September 1, 1918.

(3) Whenever it becomes necessary for a district to provide new toilet facilities before the expiration of the time limit established, such facilities must be of approved type.

128. TYPES APPROVED.—The following types are to meet varying conditions:

(1) A flush system. When water and suitable sewerage are available, schools will be expected to install this system.

(2) A dry-closet system.

(3) A chemical system.

(4) The L.R.S. type described in Public Health Bulletin No. 51, published by the United States Treasury Department.

(5) The type where watertight, nonabsorbent receptacles, easily removable, are provided and clean dust or ashes is supplied and scattered freely over the excreta whenever the closet is used. The use of this type is restricted to isolated rural districts with small enrollment and low valuation, and special permission must be secured in every case. In all types the following conditions must be met: (*a*) The closet or toilet must be in a room attached to and made a part of the school building. (*b*) The walls and ceilings of this room must be constructed and finished in same manner as other rooms of the building. (*c*) The urinals must be constructed of noncorrosive, nonabsorbent material. (*d*) In all cases the rooms must be well lighted and

Digitized by Google

ventilated. (*e*) Toilet paper, washbowl or basin, and paper towels must be furnished. (*f*) The toilet rooms must be heated in all cases where it is practicable to do so. (*g*) Before constructing sanitary closets, a simple sketch of the rooms and approaches and description of the closet must be submitted to the State Department of Education for approval. In the last three types named, the following conditions must be met: First—Receptacles must be of ample capacity and of nonabsorbent and noncorrosive material. Second—Provision must be made for the ventilation of receptacles by means of ventilators extending through roof. Third—There must be a thoroughly ventilated approach, leading to the closet from the coat room, corridor or hallway of the building. Fourth—All receptacles must be of a type to be emptied outside of class rooms, recitation rooms, hallways and toilet rooms, and the construction must facilitate this process. Fifth—The vaults must be tight, so as to render the entrance of flies, mosquitoes and other insects impossible. Sixth—Seats must be hinged and made to close automatically.

SEWAGE DISPOSAL FOR RURAL SCHOOLS

129. SEWAGE DISPOSAL.—A sewage-disposal plant for the average country school does not justify the services of a high-grade sanitary engineer. The principle involved in a bacterial sewage-disposal plant is very simple. Certain bacteria, called anerobes because they thrive only when kept out of contact with the air, have the power to reduce vegetable and animal solids to liquids and gases. Certain other bacteria, called aerobes because they thrive only when kept in contact with the air, have the power to purify this liquid product produced by the anerobes, by oxydizing it and reducing it to pure water and harmless gases. The bacteria necessary for this work exist everywhere, and all we have to do is to provide the best conditions for them to live and multiply.

If the ordinary school sewage is collected in a tank from which light and air are excluded, and from which the liquids are allowed to overflow, a thick, leathery, brown scum forms over the surface, and a black, hard sludge forms at the bottom. Experience has shown that in a month or six weeks a balance is finally struck in which the depth of the scum and sludge and the liquid between remains constant. In other words, the solid material is liquefied at the same rate at which it enters the tank. This is the ideal condition, but one seldom obtained, because of lack of undertsanding of the process going on and failure to design a liquefying tank giving the proper conditions.

Our first practical problem is to find how these two classes of bacteria work, and to design two separate bacterial laboratories in which, first the anerobes, and after them the aerobes, can work to best advantage.

Our second problem is to design these laboratories so that anyone can install them anywhere and be sure that they will work successfully. Experiment with a liquefying tank with glass sides, where the process going on can be watched by means of an electric-light bulb suspended in the liquid, shows the following process:—

Digitized by Google

TABLE OF SIZES FOR SCHOOL CONDITIONS

NUMBER OF SYSTEM REQUIRED	NUMBER OF PUPILS IN SCHOOL	DIMENSIONS OF TANKS REQUIRED FOR VARIOUS NUMBERS OF PUPILS							CUBIC FT. OF CONCRETE REQUIRED	CAPACITY OF LIQUEFYING TANK
		A	B	C	D	E	F	G		
NO.- 1	18 TO 27	7'-2"	2'-0"	2'-6"	4'-6"	3'-0"	2'-2"	1'-0"	90	180
2	24 - 36	8-2	2-0	2-6	4-6	4-0	2-2	1-0	95	240
3	30 - 45	9-2	2-0	2-6	4-6	5-0	2-2	1-6	100	300
4	36 - 39	10-8	2-0	3-0	4-6	6-0	2-8	1-6	112	360
5	42 - 63	12-2	2-0	3-6	4-6	7-0	3-2	2-0	125	420 GALLONS
6	48 - 72	13-8	2-0	4-0	4-6	8-0	3-8	2-0	140	480
7	60 - 90	14-9	2-0	5-0	5-0	8-0	4-8	2-0	150	540
8	72 -108	15-9	2-0	6-0	6-0	8-0	5-8	2-0	165	760
9	108 -162	15-9	3-0	6-0	6-0	8-0	5-8	2-0	200	990
10	144 -126	15-9	4-0	6-0	6-0	8-0	5-8	2-0	250	1320
11	216 -324	22-9	4-0	9-0	6-0	12-0	8-8	3-0	300	1980

FIG. 24

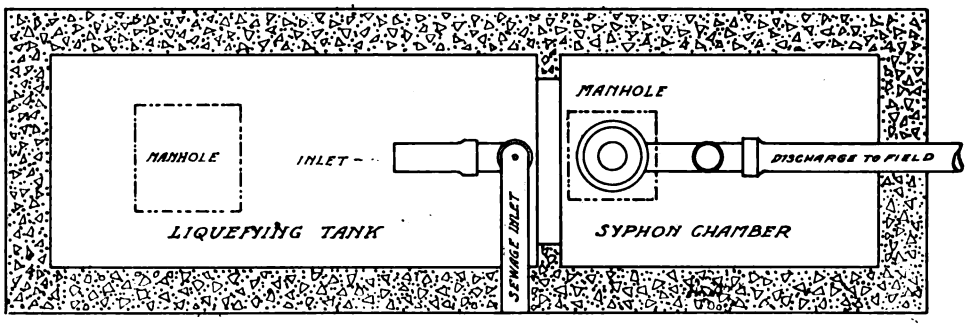
STATISTICS FOR SEPTIC TANK, SHOWING DIMENSIONS OF TANKS REQUIRED FOR A GIVEN NUMBER OF PUPILS IN THE SCHOOL BUILDING

130. BACTERIA AT WORK.—The solid matter injected with the sewage first settles to the bottom and, as it gradually accumulates, a substance resembling "moss" forms on its surface. This "moss" is filled with gas bubbles, and the buoyant effect of these gas bubbles tears pieces of the "moss" loose and it rises through the liquid. As it rises, the gas bubbles escape and allow the "moss" to fall again, and in this process of rising and falling it is gradually reduced to liquids and gases. This change to liquids and gases is due to the action of anerobic bacteria, and in order to get good results it is necessary that liquefying tanks should be a good bacterial breeding ground as well as a good bacterial workshop.

131. THE SLUDGE.—The sludge is the incubator, the scum is a protective cover to keep away the deadly air, and the space between is the workshop. A knowledge of the process and study of the plants shows that: (*a*) the scum must not be broken. (*b*) The sludge must not be disturbed. (*c*) There must be ample workshop room between. (*d*) Air must not be forced in with the sewage. (*e*) Sewage must not come in faster than the anerobes can reduce it.

A careful examination of the cut, Fig. No. 25, will show how sewage (1) enters horizontally, not downward to stir up the sludge. (2) Sewage is injected away from outlet, not towards it. (3) Sewage enters so gradually, it settles over the whole surface of the sludge. (4) The area of the outlet is eight times that of the inlet, making the speed at which the liquid sewage travels up to the overflow very slow; too slow to carry solid matter upward. (5) Entrance to outlet is vertical and does not collect "moss" or other solid matter. (6) Wide horizontal overflow enables liquid to get away easily without raising level and breaking scum when raw sewage rushes in. (7) Air and gases, which are pushed ahead by the rush of sewage through the

Digitized by Google



·PLAN OF TANK·

FIG. 25

PLAN OF SEPTIC TANK, SHOWING LIQUEFYING CHAMBER, SIPHON CHAMBER, SEWAGE INLET, SEWAGE DISCHARGE TO FIELD, MANHOLE AND FITTINGS

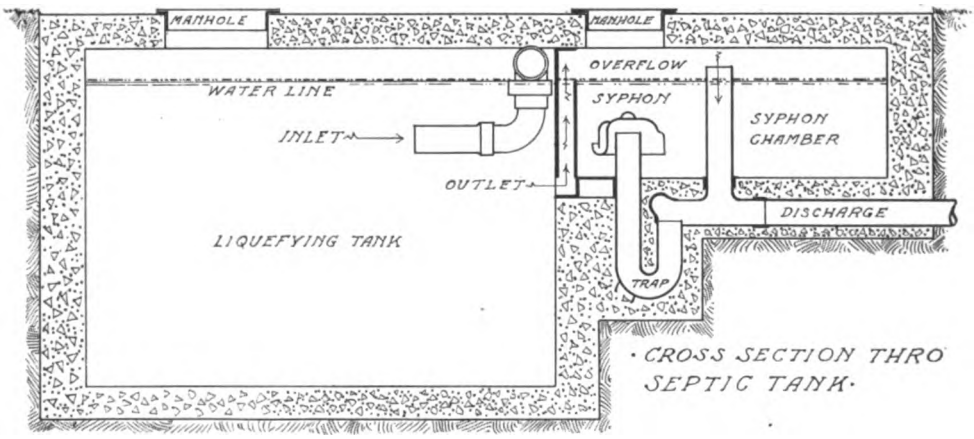


FIG. 26

CROSS SECTION THROUGH SEPTIC TANK, SHOWING LIQUEFYING CHAMBER, SIPHON CHAMBER, MANHOLES, BAFFLE PLATE AND FITTINGS

Digitized by Google

TILE DISPOSAL FIELD.

TILE SHOULD BE LAID A FOOT BELOW THE SURFACE OF GROUND WHERE SOIL IS SATURATED WITH AIR & AROBIC BACTERIA THRIVE BEST. HEAT CREATED BY OXYDIZING PROCESS PREVENTS FREEZING. BRANCH TILE MUST BE PRACTICALLY LEVEL & HOLD FULL CAPACITY OF SYPHON TANK. TILE MAY BE LAID UNDER GARDEN. TRUNK LINES ARE VITRIFIED SEWER PIPE LAID WITH CEMENTED JOINTS. BRANCH LINES ARE COMMON DRAIN TILE LAID WITH OPEN JOINTS.

TABLE OF FEET REQ'D IN BRANCHES.

Nº. OF SYSTEM	SINGLE DISPOSAL FIELD	DOUBLE DISPOSAL FIELD	Nº OF SYSTEM	SINGLE DISPOSAL FIELD	DOUBLE DISPOSAL FIELD
1	100'	200'	4	120'	240'
2	100'	200'	5	140'	280'
3	100'	200'	6	150'	300'
7	180'	360	10	420'	840'
8	220'	440'	11	650'	1300'
9	320'	640'			

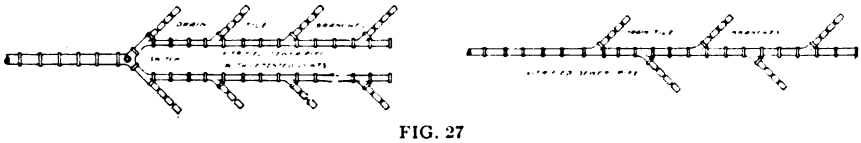


FIG. 27

Digitized by Google

soil pipe, escape through a vent and are not forced into the liquefying chamber above or below the scum. (8) Air bubbles contained in the sewage work to the surface while the sewage sinks vertically to the outlet level. (9) The whole system is vented through the soil pipe, and all odor and gases are discharged through the soil-pipe stack above the roof.

132. LIQUEFIED SEWAGE.—Liquefied sewage is not purified (oxydized) sewage. It may look harmless, but it is not until it has been oxydized. To run liquefied sewage into a tile, cesspool, or sub-well without purifying it is a greater menace to health than to treat raw sewage in the same manner, because the liquid sewage flows through the ground and pollutes well water at a much greater distance. The ground itself becomes "rotten" because the air and bacteria required for oxydizing are found close to the surface only.

133. LIQUEFYING CHAMBER.—Having designed a liquefying chamber, so shaped, proportioned and equipped that it gives the best results, our next step is to purify the liquid sewage which overflows from this chamber. This is an oxydizing process due to the action of aerobic bacteria, and if properly performed the liquid sewage is reduced to a harmless gas and pure water. The best condition for this bacterial action is obtained when the sewage is spread out in a thin film, exposed to air and excluded from direct sunlight. In large plants the usual means of doing this is through "contact beds" of sand or crushed rock or coke, but in small plants the only practical way is by subsurface irrigation, which is simply letting the liquid sewage seep into the ground through common draintile laid just below the surface of the ground where the soil is saturated with air. The ground within a foot of the surface always contains aerobic bacteria which multiply enormously when properly fed. They are easily drowned, however, and must have a breathing spell after each ducking with sewage.

134. SYPHON.—To meet this requirement, the liquid sewage as it overflows from the liquefying tank is retained in a syphon tank and discharged periodically by an automatic Quinn syphon into the tile-disposal field. As a result, the bacteria which cover the surface of the tile and the surrounding soil are first doused with sewage and then exposed to air as the water is absorbed into the soil and its place is taken by air from above.

135. FILLING TRENCHES.—In heavy clay soils it may be best to fill tile trenches with sand, and possibly to underdrain the fields. The work can be done by any man who can lay draintile, and as the whole system is under ground, no foul odors can escape and there is no danger of the spread of disease germs through the air by flies. It is a dooryard proposition and may underlie the lawn or garden.

The heat contained in the sewage, and that generated in the oxydizing process (which is simply slow burning), is sufficient to keep the ground from freezing in winter.

136. DISPOSAL FIELD.—The connecting pipe from siphon chamber to tile-disposal field should be glazed sewer-pipe with cemented joints. The

Digitized by Google

tile in the disposal field should be common four-inch land tile, and should hold the full capacity of the siphon chamber, at least. It should be laid practically level, so that the liquid sewage will fill all parts and work off into the soil equally. The tile may be laid in a long run, straight or curved, according to the contour of the ground. In clay or other compact soils it is better to have two disposals fields and discharge the sewage into each alternately. This gives the bacteria a chance to get air and oxydize and let excess sewage in the ground. Special tile or caps or gutters are not required. All except the switch may be bought in any country town. The siphon discharge is absolutely necessary to the proper working of a tile-disposal field. If the sewage dribbles as it comes in from the liquefying chamber, it is continually absorbed by the ground at the upper end of the draintile which soon becomes saturated and foul. The bacteria at this end die from lack of air while those at the lower end die from lack of sewage to feed on.

137. WATERPROOFING CONCRETE TANK.—The concrete used in building the septic tank should be waterproofed by the "integral method," i.e., mixing a waterproof compound with the water that is used for mixing the cement.

SANITARY WATER SUPPLY

138. SANITARY WATER SUPPLY.—Springs and wells are the usual sources of water supply. The springs are usually at some distance from the schoolhouse, generally on lower ground. They are often exposed to contamination and receive drainage from swampy ground, much-used pasture lands, or defiled areas. In fact, they furnish merely slightly purified surface water, and in some cases they issue in open pools. These pools are depositories for leaves, dust, and dirt. Insects find lodgment therein; various animals share in their use. Despite all these sources of pollution, most people are brought up to believe that no water is as pure as "spring water." There are many springs that furnish fairly pure water, and many others which if properly cared for would be safe.

Possibly of all springs the small intermittent, dribbling ones are the most dangerous. Getting their supplies from the immediate surroundings, they discharge surface drainage which has had small opportunity for purification, either by filtration or by other means. Springs in limestone regions are often subject to contamination by reason of the fact that the underground channels through which the water flows are often connected with sinkholes partly filled with water and used as a water supply for cattle and other domestic animals. Water from such a source may carry long distances with limited opportunity for aeration, filtration or purification of any kind. All these facts, and others which might be mentioned, emphasize the need of caution in the use of springs as a source of water supply for schools.

139. WELLS.—A dug well can be made safe, provided all water flowing into it comes from a pure source; but it will cost more than many school boards are willing to spend to make it safe.

Digitized by Google

140. A driven well can often be sunk to a much greater depth, thus insuring better filtration. It can be cased in, as readily, to cut off surface drainage, and it frequently costs less than a properly-constructed dug well; hence the driven well should be preferred in country schools. The only advantage such a driven well would have over the dug well would arise from the fact that, unless the dug well were securely covered and the casing made watertight to the lowest water line, such filtration into the driven well would be accomplished more slowly, and more opportunity would be offered for purification. The main source would be the same in either case.

Sometimes, especially in mineral regions, a deep well will draw its supply from highly-mineralized waters, and they may furnish water disagreeable to the taste and even dangerous for drinking. Some mineral waters are wholesome and healthful, but it is always safe to know the chemical constituents of suspected water before using it freely.

Wherever a good water supply can be reached at a good depth the driven well is safer, because there is less opportunity for defilement. The foundation carrying the pump should be of cement and a ready means provided for carrying away waste water.

When a driven well is properly placed, and is sufficiently deep to warrant a supply of pure water, a drinking fountain can be attached to the pump as indicated. This will necessitate a good foundation about the pump and about the drinking fountain, and such an attachment of the foundation to the pump that the pressure tank will be below the freezing line and also deep enough to keep the water cool in summer. If the well is a driven one, an excavation sufficiently deep and its connections well below the surface of the ground may be made, and the attachment made to the pump in the same fashion as shown in cut.

If a large pressure tank were substituted for the small one shown, not only could a drinking fountain be supplied, but lavatories and flush toilets, and a faucet for hose as a protection against fire or for garden use could be installed, because all that would be needed would be the necessary pipe connections. Naturally, the drinking fountain, the tank, or any outlet from this pressure tank could be located where desired.

141. Drinking Cups.—Another source of danger lies in the use of the common drinking cup. It is quite possible for the school boards to provide the cheaper variety of paper drinking cups, such as are used in trains, and to have a receptacle for receiving the cups. A move in that direction will be well taken and will be to the advantage of the pupils, since a few weeks' sickness through colds, measles and other epidemics is to be deplored during the school term.

FIREPROOFING THE SCHOOL

142. Fireproofing.—Statistics compiled by the National Board of Fire Underwriters, through its Actuarial Bureau, shows that there are on the average, day in and day out through the year, about five school fires, which,

Digitized by Google

of course, are of varying degrees of seriousness. Recorded schoolhouse losses in the United States during the four years 1916 to 1919, inclusive, amounted to $19,846,038. These figures, however, cover only properties upon which losses were paid by members of the Actuarial Bureau, and if twenty-five per cent be added, to allow for unreported fires and those in uninsured structures, the total would reach $24,807,547, all of which represents wasted labor and materials. Furthermore, these fires endangered thousands of young lives. Of more importance than the safety of property and perpetuation of architectural creations is the question of human safety. Every once in a while a

FIRE LOSSES IN SCHOOLS
Including Those in Universities, Boarding Schools, Convent Schools and Academies.

Cause	1919 Losses	1918 Losses	1917 Losses	1916 Losses
STRICTLY PREVENTABLE CAUSES				
Defective chimneys and flues	$556,427	$353,851	$301,365	$430,370
Fireworks, firecrackers, etc	18,896	36	31,455	...
Gas, natural and artificial	33,659	36,166	28,987	65,292
Hot ashes and coals, open fires	77,391	63,579	37,501	32,277
Ignition of hot grease, oil, tar, wax, etc.	980	1,259	70	261
Matches—smoking	197,061	250,408	259,287	204,726
Open lights	396,561	10,423	8,454	49,414
Petroleum and its products	85,032	26,552	14,633	118,235
Rubbish and litter	2,871	19,328	33,937	22,350
Sparks on roofs	316,588	265,909	239,046	133,091
Steam and hot water pipes	14,529	50	1,008	25
Stoves, furnaces, boilers and their pipes	523,469	645,595	645,725	464,814
Total	**$2,223,464**	**$1,673,156**	**$1,601,468**	**$1,520,855**
PARTLY PREVENTABLE CAUSES				
Electricity	$472,853	$559,068	$506,632	$585,054
Explosions	35,094	5,890	76	2,469
Exposure (including conflagrations)	117,260	488,659	156,877	268,573
Sparks from machinery (friction)	51,751	6,952	110	6
Incendiarism	162,735	180,663	32,737	428,364
Lightning	78,643	193,225	199,789	61,811
Miscellaneous known causes	57,652	135,090	73,758	85,050
Sparks from combustion	14,258	3,829	37,865	4,708
Spontaneous combustion	165,147	302,769	335,130	449,697
Total	**$1,155,393**	**$1,876,145**	**$1,342,974**	**$1,885,732**
Unknown (probably largely preventable)	2,494,788	2,026,840	1,114,120	931,103
Grand total	**$5,873,645**	**$5,576,141**	**$4,058,562**	**$4,337,690**

school fire is recorded where there is miraculous escape from death because the fire chanced to break out while the pupils were absent. But such good conditions do not always prevail. On March 4, 1908, a school burned in Collingwood, Ohio. In that fire, two teachers and one hundred seventy little children lost their lives. Ohio profited in knowledge by that disaster, and she now stands among the leaders in the States that have made an attempt to legislate wisely as regards schoolhouse construction, safety and protection. The conscientious architect can be of great and lasting service to rural school districts by including in his plans proper and adequate protection for the children by demanding that the corridors and stairways at least be constructed of fireproof material. It is not simply a professional duty on the

Digitized by Google

part of architects to do what they can to safeguard the lives of the children; it is a moral obligation of citizenship, and one which by reason of his training and education an architect should more readily realize and more effectually discharge than can any layman. How many laymen have realized or would believe that the school is really the most important of our civic buildings? Yet the lives these buildings shelter are by far the most valuable in any community.

FIRE ALARM

144. FIRE ALARM.—Every building that is more than one story in height should be provided with a fire-alarm system with gongs that can be heard in every room, including the basement rooms. The system should be tested at frequent intervals, so that it may be known that it is in working order. Fire drills must be given once a month, according to law. They should be given oftener and actually using the fire escapes is specially recommended as familiarity therewith lends speed and lessens confusion should an emergency arise.

VOCATIONAL AGRICULTURE IN THE HIGH SCHOOL

145. During the past ten years in New York State there has been an unusual development of interest in the teaching of vocational agriculture in the public schools located in thirty-five counties in which four-year agricultural courses have been organized. Each year from ten to fifteen new schools established this work. A general survey of the high schools of the State indicates that from one hundred fifty to one hundred seventy five strong courses may ultimately be organized. Agricultural courses are organized as a department of the school and are in every way an integral part of the public-school system. They are designed primarily to train for the vocation of farming the boys and young men residing on the farms in the vicinity of the school—pupils pursuing an agricultural-course study in addition to four years of agriculture, English, mathematics, science and history. Also special courses are offered for the boys who cannot spend four years at school. These courses offer intensive instruction in agriculture during a short period in winter or for a full year or more. Pupils who complete the prescribed agricultural curriculum are entitled to receive a diploma issued by the State Department of Education. This diploma will admit pupils to the colleges of agriculture in the State.

146. ROOMS REQUIRED.—The rooms and equipment provided for a department of agriculture should be as modern and convenient as for any other department in the school. Rooms are not to be used for this work unless they are well heated, lighted, ventilated and sanitary. Provision is made for two rooms: laboratory and recitation room, and farm shop. The laboratory and recitation room and its equipment furnish a means for demonstrating various phases of agriculture and afford an opportunity for securing individual experience. One large room properly equipped to serve as a

Digitized by Google

FIG. 28
INTERIOR VIEW OF FARM SHOP

combination laboratory and recitation room has been found most satisfactory. This room should have running water and gas when possible. To save cost of plumbing it is better to have the water taps in the laboratory at one sink in a single drain. If gas is inaccessible, alcohol or other burners should be provided. The agricultural room should be near the ground floor with easy access to the outside of the building, so that classes may readily pass in and out without disturbing others.

147. LABORATORY EQUIPMENT.—Laboratory tables, approximately six feet by two feet six inches, provided with three drawers, supply all needs for laboratory and recitation purposes. An arrangement of these tables, as shown in Fig. No. 29, with chairs for three pupils at each table, furnishes good seating accommodation for class work. Adequate provision should be made to accommodate bulletins and periodicals. Bulletin-holders or boxes, or a bulletin case such as the one shown in Fig. No. 29, are convenient. A rack on which the current issues of the agricultural periodicals may be kept is also desirable. The bulletin case and periodical rack may be built in the farm shop. Ample case room should be provided for apparatus, laboratory supplies, and demonstration material. The upper doors should be of glass so that materials may be readily located. The lower doors should be of wood, since glass so low down is frequently broken. The laboratory and recitation

Digitized by Google

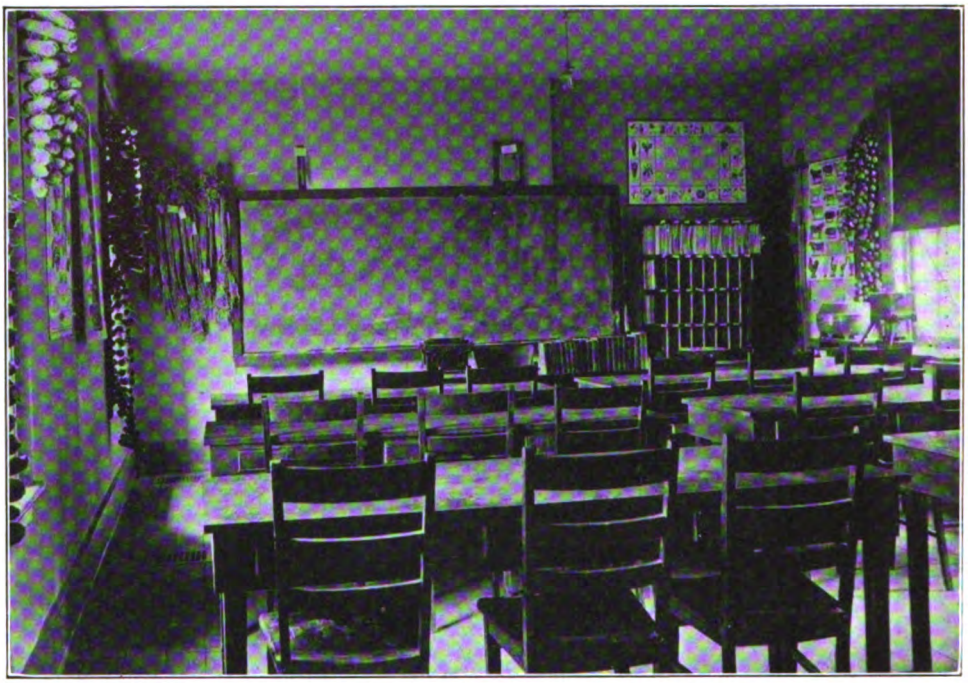


FIG. 29
LABORATORY AND RECITATION ROOM IN AGRICULTURAL SCHOOL

rooms should also contain plenty of drawer space. If possible, all cases should be mouseproof, so that grains and other edible materials may be safely stored. The blackboard should be mounted in a frame so squared up and finished that a T-square may be used for the construction of blackboard figures. The purpose of the farm shop and its equipment is to furnish a means for instructing pupils how to do the repair and construction work which ordinarily needs to be done on a farm. Consideration should be had for: (*a*) The fundamental tool operations. (*b*) Care and sharpening of tools. (*c*) Construction practice definitely related to the projected work of the pupils. During those years when shop work is not definitely scheduled as a part of the course of study, the shop should be open and in running order, and pupils should receive instruction in special phases of shop work which develops as a result of their projected study and class work. Under average conditions, a room for shop work can be provided, and should be at least sixteen by twenty-four feet in area, well lighted and preferably with southern exposure. Rooms not already suitable for the purpose may often be converted at small expense. If absolutely necessary, a basement room may be fitted up, but in that case, additional windows will frequently be needed.

148. THE SHOP.—The shop should be provided with portable benches. A bench, sixteen by four feet, provided with three vises on each side, designed by the Department of Rural Engineering, State College of Agriculture, Ithaca, has been found very satisfactory. This bench accommodates

Digitized by Google

six pupils, and under average conditions at least two such benches are necessary. The benches should be placed so as to fully utilize the floor space for handling lumber and work with saw horses. It is suggested that provision be made in each shop for a bench with both a wood and metal working vise, such as might be used on a farm. A lumber rack, usually built by the agricultural class, is an essential part of the farm-shop equipment. Experience indicates that the best arrangement for the tools is to provide one or two wall cabinets, approximately six by four feet, and ten to twelve inches deep. The cupboard doors should be hinged at side and fitted with a hasp and lock at the middle. The ceiling of this room should be properly prepared to deaden the sound of work being done in the shop. The underside of the joists overhead should be sheathed with deadening felt or fiber, and this covered by a tight wooden ceiling, or lathed and plastered. Metallic ceiling should not be used because of its sound-conducting properties. The floor should be of wood, as cement floors are cold and hard on the feet, also an edged tool may be spoiled if dropped on a cement floor. The shop room should contain a blackboard, as previously mentioned, for the use of a T-square.

149. EQUIPMENT.—If such a department for agricultural training is to qualify for State and Federal aid, provision must be made for the minimum list of equipment provided by the State Department of Education. This equipment costs approximately $500.

150. STATE AND FEDERAL AID.—The amount of State and Federal aid available for agricultural courses makes possible the employment of a teacher with special training and experience at a low cost to the local community. The following tables show the net cost to the local community and the reimbursements from State and Federal funds when different salaries are paid.

Salary	Net Cost to Local Community	Reimbursements State Funds	From Federal Funds
$1400	$200	$1000	$200
1500	233 1/3	1000	266 2/3
1600	266 2/3	1000	333 1/3
1700	300	1000	400
1800	333 1/3	1000	466 2/3
1900	366 2/3	1000	533
2000	400	1000	600
2200	466 2/3	1000	733 1/3
2400	533 Maximum	1000	866

MOTION PICTURES

151. "Within the next few years, the motion picture will be an indispensable adjunct for every leader and educational lecturer." This, from a recent report of the United States Bureau of Education, immediately makes

Digitized by Google

a suggestion which school boards of even the smallest schools will do well to consider. The widespread use of films in schools is an assured future development which is destined to materialize in the next few years. Educators recognize the vast potential value which films hold as a means of instruction. The advantages which properly-designated motion pictures hold for school use may be briefly summarized as follows: They can (1) Attract and hold the attention of the pupils as can few other forms of instruction. (2) Present abstract and complex subjects in clear, simple, exceedingly graphic and easily-understandable form. (3) Substitute a definite, visible and vividly-real picture instead of an abstract and vague picture of the imagination, which in many cases is found to be not the same in two minds out of an entire class. (4) Create a more lasting impression. (5) Make the absent visually present. (6) Make inanimate objects animate; dead objects, alive. (7) Slow down and analyze rapid motion. (8) Accelerate and synthesize slow process. (9) Save time of pupils and teacher by enabling the former to gain in a short time the mastery of a subject of which they hitherto have attained only a dubious understanding after prolonged effort. (10) Make minute objects, ordinarily seen by only one at a time with difficulty through a microscope, magnified to a size easily visible to a whole class at once. (11) Repeat indefinitely anywhere, and at small expense, experiments and demonstrations performed with ideal equipment and under the best possible conditions. (12) Present upon the screen, in large size so that all may see, the details of such proceedings as surgical operations performed in the clinic which ordinarily are viewed from the gallery by only a few fortunate students. The camera can in such cases be placed very close to the object. (13) Make schoolwork pleasanter.

Cases have arisen where the motion-picture machine has become a strong feature in promoting community spirit; where, for instance, some rather more than ordinarily farseeing trustee purchased a machine which was used not only for teaching purposes in the school but for community entertainments, whereby, through charging a merely nominal fee for admission, it was found that the machine more than paid for itself and its upkeep in a few months.

While hitherto most educational films have been produced primarily for theater use, pedagogical films are now being produced on a large scale by educators, paralleling standard textbooks, for class-room use. Motion pictures are a modern development which have become a permanent factor in our growth, and provision must be made for them accordingly; we cannot hold back the wheels of progress.

The well-appointed school should be equipped properly for efficient use of standard film on a standard projector. For the small school which cannot make such provision, the noninflammable film is available, but machines are now being produced which are safe for the projection of any type of film. Even the smallest schools, however, and in individual class rooms of all schools, provision should be made in the plans for darkening without interfering with ventilation, and for wall-screen space suitable for film projection.

Digitized by Google

The school which because of the lack of foresight of its architect is unable to use motion pictures will be deprived thereby of one of the most efficient means of instruction that this century has perfected and made available to all.

A GOOD CLOCK SYSTEM AIDS EFFICIENCY

152. Among the various equipment which goes to make up efficiency in the modern school, perhaps nothing is more welcome to principals and teachers, nor does more to install habits of regularity and punctuality in the pupils, than a good automatic-clock system. A good many of us are familiar with the old-time nuisance of gongs and manually-operated electric bells and, consequently, appreciate what a boon it is to be free from this. With thorough installation of a really first-class system, the whole matter of class hours and program can practically be left to the system itself, and so satisfactorily have such systems been worked out that they are troubleproof and require only a moment of attention weekly, and that need not be at all of a skilled nature.

The application of modern electrical methods has accounted for what appears to be almost miracles in the operation of these clock systems. For instance, with a master clock, with program attachment, installed in the principal's room of the school office, not only may the periods of the various classes be announced but playground gongs, fire-alarm, and other special calls almost without limit may also be provided for. The systems are operated usually from storage batteries fed by the local electric lighting circuit, and the consumption of current is so small as to be inappreciable.

For schools or colleges with highly-developed physical laboratories, such systems again can be equipped to operate sounders, second beat clocks, and other apparatus. This can be provided for rather remarkably with very little additional equipment, and thus avoid the duplication of systems which until recently has been necessary.

THE PHONOGRAPH IN THE SCHOOL

153. THE PHONOGRAPH.—Ten years ago, almost any school trustee would have looked askance at a suggestion from a teacher that a phonograph be introduced in his school. In the last few years, however, with the development of music in so many ways as an aid to educational methods, the instrument is becoming a familiar and very valuable feature in the best schools.

In considering the use of such an instrument, the kindergarten, of course, looms up as the grade where it can most widely be utilized. With the production during the recent years of such an abundance of educational songs and story records, the phonograph immediately makes itself felt as almost a necessity. These days, too, many a jangling piano indifferently played for marching and for the kindergarten games is being replaced by phonographic music.

Digitized by Google

This can be supplied in such an abundance and in such varied form that not only can the child be given an early acquaintance with the best class of music but his musical appreciation may also be developed on sane and correct foundations.

But the use of the phonograph is not by any means confined to kindergartens. As familiarity with the use of the instrument grows, the possibility of use in the higher grades becomes more and more evident. Many teachers like to introduce some of the best and of the newer songs, and this cannot be done in any other way so well as it can by the reproductive instrument. Here again, too, the phonograph can be used to advantage, and repeatedly in the various drills and exercises called for in the school curriculum. One of the newer uses of the machine, and one which is receiving a good deal of attention in the most modern schools in the United States, is for the development of the appreciation of rhythm in writing exercises. Anyone who has studied the psychology of penmanship knows that rhythm is the basis of good writing. Picture then, as compared with the schools we grown-ups knew, a modern writing class listening to appropriate and educational musical selections and at the same time practicing the required exercises. This is one of the ways in which the tiresome things of the old school days which led to truancy among the boys, and sometimes to malingering among the girls, are gradually being done away with.

Neither is the use of the phonograph confined to the inside of the school room alone. In these days of group games, illustrative dances, and other forms of helpful physical exercises leading to a development of self-expression and initiative, the larger and more powerful forms of the machine are coming into ordinary use. Placed in a corner of the playground, with the breeze blowing from the instrument to the children so as to carry the tone, the phonograph such as supplied for school use will readily carry music for one hundred children, and will delight them as well as stimulate and aid in their exercises.

Nor need there be any difficulty in transporting this wonderful producer of all kinds of music from room to room and from the school to out-of-doors. Latterly, very reasonably-priced machines are supplied mounted on wheels which may readily be rolled anywhere, or even taken up and down stairs with very little difficulty.

TELEPHONE SYSTEM

154. TELEPHONES.—During the past few years, the telephone has passed through a remarkable era of improvement and is now utilized in hundreds of ways which were not even dreamed of a generation ago. It finds a large place in the school, mainly because it makes possible perfect co-operation between principal and teachers. Every day, problems arise which require the attention of both principal and teacher, and if either of them must leave an important post to journey to the office or class room of the other, much valuable time is lost and frequently difficult situations are

Digitized by Google

created. No industrial institute is considered in any way modern which does not utilize a private telephone system, and such a system is just as requisite in a school. Certain of the newer systems provide not only communication between the individuals but arrangements may be made with very little additional cost to install a system so that a general conference may be carried on. Again, the telephone bells may be utilized for signaling classes for fire drills, for dismissals, and various other purposes which will suggest themselves. Trustees considering the erection of a new school building should consider the telephone system as an indispensable feature of the institution. Even in rural sections, where connection with a public system may not be available, a small private system is readily operated by inexpensive dry cells. It is in every way practicable, and will repay its cost in a very short time.

HEATING AND VENTILATING

155. FOREWORD.—It is not our intention within the scope of this article to design a heating and ventilating system. This information may be found in the works of Carpenter, Baldwin, Snow and others. Our object is to provide such information as will give the members of the school board a fairly comprehensive knowledge of the different heating and ventilating systems that are usually installed in public school buildings. It is essential that at least one member of the board should have this knowledge as, frequently, expensive systems are installed in schools and these are never properly used. On one occasion the writer visited one of the largest and best known public schools in New York State and found that the janitor was running the fan only during recess and at the noon hour. In answer to our query why this was done, he said that he had been instructed by the principal to "air" the school by means of the fan instead of opening the windows. When we told him it would be better if he would run the fan during the time when the building was occupied, and if he wished to "air" the school at any other time, he might do this to advantage by opening the windows, he referred us to the principal who said that this was the way he understood the system was to be run, as otherwise the cost of heating and ventilating the school would be high. In several interviews with members of the school board they said that they were satisfied with the heating and ventilating system, and that they had found the best results were obtained by operating the system as above. Here was a case where the object aimed at in the design of this heating and ventilating system was not obtained and the money spent in the installation had been simply thrown away.

In many buildings the ventilating system is an integral part of the heating system. An example of this is where a building is heated and ventilated by hot air, also by the so-called hot-blast system.

In other heating and ventilating systems while the ventilating section may be incorporated with the heating they are not inseparable in design or in practice.

Digitized by Google

With the warm-air and hot-blast systems the heating of the rooms is effected by circulation, whereas with other systems it is by radiation, air being supplied only for ventilation. However, in the comparatively mild days of spring and fall, a building may be made comfortably warm by the operation of the ventilating system only.

156. EMPLOYMENT OF INDEPENDENT ENGINEER.—It is our recommendation that the school board employ an independent consulting engineer to lay out the heating and ventilating system, or to employ an architect who has made a special study of the subject. Frequently, the practice is to have the plans for this very important part of the building designed by an engineer who is employed by some manufacturing concern, and the specifications, instead of covering the best material for the purpose, only mention material manufactured by the firm employing this engineer. An independent engineer of experience will design a system and specify only the material consistent with the amount the school board is prepared to spend. More than once it has been the experience of school boards to have a plan and specification presented for their approval, this specification demanding certain specialties that are properly used only in connection with a system entirely different from that required. These specialties may be valueless in connection with the system specified or proper provision may not be made for such special requirements as are essential to the proper working of that system.

The engineer's duty should not cease with the preparing of plans and specifications. He should be employed to inspect the plant from time to time during the installation, and should also make a final test of the plant and instruct the attendants in its proper operation.

SYSTEMS OF HEATING

157. WARM AIR.—In small schools where the appropriation is not large, a warm-air system of heating and ventilating may be used. It is not recommended for buildings having more than four rooms.

Separate furnaces should be provided for each side of the school, and the furnaces placed under the ducts which should be installed along one side of the room. These furnaces must be extra heavy as the demands made on furnaces on school work is very great. With the ordinary light type of furnace, a hard fire followed by a sudden cooling causes openings of the joints, thus allowing the escape of the products of combustion into the class rooms. If the furnace is large and heavy the slow fire will give added life to the apparatus and a better quality of air will be admitted into the rooms. The furnace should be brick-set and equipped with vaporizers. Herewith is given a description of how the warm-air system works.

The furnace is set in a brick chamber having openings about twelve inches high at the floor line for the admission of cold air, and openings also at the floor line into the fresh-air flues. The flue openings are for the purpose of allowing a certain amount of unheated air to enter the fresh-air flues. Air from outdoors is admitted to the fresh-air room and passes into the heater

Digitized by Google

chamber and over the furnace. Here it becomes warmed to the required temperature and enters the fresh-air flues. From these flues it escapes into each classroom at about eight feet from the floor line. The fresh-air stacks are equipped with mixing dampers controlled individually from each class room by means of cable and chain. One operation of the damper shuts the cold-air bypass at the fresh-air flue and the reverse operation closes the opening at the warm-air furnace. In intermediate positions the damper will temper the incoming air to the required temperature.

The foul air is drawn from the room at the floor line and at the side of the room in which the fresh air enters. The foul air drops into a chamber in the basement and from thence to a large brick stack. This stack generally contains the smoke-flue. The heating of the flue tends to create an up-current of air, and this, together with the relative difference in the temperature of the inner and outer air, creates sufficient draft to draw the foul air from the building.

In the morning, and at other times when the school is not occupied, the door of the main vent shaft is closed and the air returning from the class rooms is permitted to pass by way of the fresh-air room back and over the furnace.

Where a system of this kind is installed, care must be exercised to see that the janitor always leaves the opening into the vent stack uncovered when the building is occupied. The temptation is to save fuel by closing this door. The main vent shaft should always be supplied with a small stove (for use in warm weather only), so that a positive up-draft can be obtained by way of this shaft.

It is only where the funds will not permit of the installation of a more modern plant than a hot-air system that this type may be recommended. There are certain defects in this system which cannot be overcome.

For instance, the air must be raised to a very high temperature, and since the air is brought to the furnace chamber at a very low temperature, the percentage of moisture contained in the air is very small. In raising the temperature of the air it becomes dry and even parched. Such air when introduced into a school room will absorb moisture from the skin and from the lining membranes of the eye and ear passages.

It is difficult to add moisture to the air by means of the ordinary vapor pans supplied with the furnace. There are several humidifying devices on the market that may be installed in connection with warm-air furnaces, and some one of these should be installed in every case.

These vaporizers are often made in the form of a vapor pipe extending up over the dome of the furnace. The water is supplied by an automatic supply tank fitted with a ball cock, thus assuring a constant supply.

A simple test of the proper proportion of vapor in the atmosphere may be made as follows: Take two ordinary thermometers. Wrap the bulb of one in a muslin sack, having one end of the sack in a glass of water. The reading of the dry-bulb instrument should not differ more than from five to ten degrees from that of the wet-bulb thermometer.

Digitized by Google

Later in this article, the subject of humidity is taken up at greater length, but as one of the greatest objections to the hot-air system is the dry quality of air delivered, it is only expedient that the question of humidity should be touched on in this section dealing with warm-air heating systems.

With warm-air heating systems there is also the difficulty of proper distribution of heat. On the windward side of buildings the rooms are often not heated, while those on the lee side may be very warm.

158. COMBINATION SYSTEMS.—The claim is advanced by the advocates of this type that the heating of the building may be effected by means of direct radiation and that the air for ventilating may be warmed by passing it over the furnace part of the steam or water generator. While this may be installed at a lower figure than a steam or water system, the objections to the quality of air delivered in warm-air systems are also to be considered here.

159. STEAM.—The most common method used in the heating of large office and apartment buildings is that of employing direct steam radiation. The radiators are located along the outside walls, in the hallways and in such other exposed places as are subject to the cooling effect of drafts, etc. In heating a school building, the radiation can be placed in a similar manner and provision made for bringing fresh warm air into the rooms either on the gravity, vacuum, or plenum principles. The radiators are supplied with steam either by means of the one-pipe or two-pipe system, or such other modifications of these systems as are on the market under different names.

The usual system of piping for steam systems is the so-called one-pipe. In this the radiator has one tapping, and that at the bottom. The steam is admitted to the radiator through this opening and the condensation returns back through this same opening to the steam main. The main is simply a complete circuit from the feed opening of the boiler to the return opening. The steam that is generated in the boiler passes up into the main and condenses in the radiator. The condensation returning flows by gravity back to the return opening of the boiler. When the pipes are arranged with sufficient fall, and are of ample size, a satisfactory system of piping may be arranged in this way. The one-pipe system is the cheapest form of pipe installation, and for a building not requiring very long runs can be installed to advantage. The average journeyman is more familiar with this system of piping than with almost any other. Therefore, there is less danger of a faulty installation with the one-pipe system than with another system installed by men who are not conversant with its principles or where the installation is not made under the supervision of a competent engineer.

One of the objection to the one-pipe system is that a radiator must be turned all off or all on. If there is a full steam pressure on the boiler and the valve of a cold radiator is turned on, the condensation that is in the radiator meeting the incoming steam causes a hammering noise.

With the one-pipe steam job there are several systems of venting the radiators, the most common being that of automatic air vents. These vents are fitted with expansion members so that the air can escape from the

Digitized by Google

radiator, but steam coming in contact with this member expands it and prevents the steam escaping. In many of these vents no provision is made to prevent the return of air to the radiator, so that when the pressure drops in the system the air rushes back through the vent openings and before the radiator is filled with steam again this air must be displaced. Other air vents on the market close against the return of air.

In some systems the air vents are connected with an air line, this being connected either with an electric or hydraulic pump in the basement. With other systems this air line vents into the boiler room or into the chimney. With a pump system there is a vacuum created in the radiators and this means that steam will be generated in the boiler at low temperatures.

In course of time the expanding element in the air vent becomes defective, thus requiring adjustment. Some air-vent manufacturers make these vents so that they cannot be opened by unauthorized persons, thus making for long and effective service.

Cheap air vents should never be used except on temporary work.

160. Two-Pipe.—In the two-pipe pressure system and also in the two-pipe vacuum system the installations are made as the name would imply, by means of two pipes. One pipe supplies the steam and the other pipe carries away the condensation, and in certain systems also air from the radiators. Some of these systems have the feed pipe at the top of the radiator and some at the bottom of the radiator. In all cases the return pipe is at the lower end of the radiator and opposite to the feed end.

There are so many two-pipe systems on the market under different names, and differing somewhat in principle, that an extended explanation, or even a slight mention, of these is almost out of the question within the space at our disposal.

The two-pipe pressure system is generally installed with a valve at the feed and return. In some cases the return valve is in the form of a trap. This trap is either built on the flotation or expansion principle. There are many thousands of installations of this type in use in connection with pumps and also to a limited extent installed as gravity systems. For large installations these systems are highly recommended, but for small installations where the services of a competent attendant cannot always be obtained it is better to have installed some of the better known gravity systems of steam circulation. There are several modifications of the vacuum vapor systems on the market. All of these systems have their merits, but they are not all suitable for school work. Frequently, salesmen of competing houses will point out defects in other systems, and the points to which they take objection can generally be explained away by the salesmen for the goods condemned. It is here that the advice of an independent engineer is to be desired.

Herewith is a brief description of some of the gravity vacuum vapor systems on the market:—

In these systems the chief point is the return trap. The traps are placed on the return end of the radiator and are fitted with a flotation or expansion

Digitized by Google

member. The steam is admitted into the radiator at the opposite end to the trap. The air that is in the radiator is driven ahead of the steam and passes by way of the trap to the return line. The condensation also follows this same passage. When the steam strikes the trap, it closes, thus preventing the escape of steam to the return line. The air is drawn from this line into the atmosphere and the condensation is returned to the boiler.

If there is sufficient headroom above boiler, and this piping is properly proportioned it works well, but if there is not sufficient head there is a danger of the system finding a dead center and becoming inoperative.

There is also a system on the market where the specialty is the feed valve, these valves being proportioned so as to admit only enough steam to the radiator to fill it. The theory is that before it reaches the return end of the radiator, the steam is so condensed that there is little chance of any of it finding its way into the return line. The trap on this system is simply a water-seal with a bypass for air. The traps connect to a return air line in the basement, this return line venting to the atmosphere and connecting with the boiler below the water level. The boiler, when installed with this type of system, must be equipped with a very sensitive automatic damper regulator, so that at no time will there be much pressure developed. Otherwise, the seals in the traps are blown out and the steam enters the air line and escapes into the atmosphere.

In another system, with graduated feed valves, the return end of each radiator is fitted with an elbow with a small check. The check prevents the return of steam or condensation from the air line to a radiator that may be turned off. This system, inasmuch as the return line feeds to the atmosphere, is open. The end of the line is equipped, however, with an expansion member or controller, so that if steam enters the return line when pressure is generated at the boiler the expansion member is closed and there is no danger of steam escaping.

Where systems mentioned here as vacuum vapor, show that the principle worked on is the graduated valve, these valves must be installed in accordance with well-defined rules, otherwise they will not give satisfaction.

161. HOT WATER.—In many localities a marked preference is given to hot-water heating systems and there are certain outstanding merits of this system that can hardly be offset by its defects.

The principal defect of the hot-water heating system is that there is so much water to heat that it is impossible to get quick response to firing. There is also danger from frost. Again, the radiating surface must be much greater than with the steam system. But the quality of heat from hot-water radiation seems to be more pleasant than from steam radiators.

Hot-water heating systems may be installed on the forced circulation principle, whereby the size of the radiators can be materially reduced as may also the size of the piping: In this system a steam boiler is used in connection with a hot-water generator, steam being supplied directly from the boiler to the ventilating coils, as this is the only part of the plant where steam is used

Digitized by Google

as a direct heating medium. There is also a main connecting the boiler to the generator. The generator is generally made of copper or brass tubes. The steam passes through the tubes, and surrounding the tubes there is a body of water. The generator is supplied with a feed pipe to the radiators and return pipe from them. Many of these systems have been installed throughout the United States and are giving excellent results.

VENTILATING SYSTEMS

162. It seems almost unnecessary to write ofthe importance of having a well-designed and properly-operated ventilating plant installed in every school building. These buildings must be ventilated while they are occupied and some system must be installed to maintain a certain standard of purity in the air breathed by the occupants for so many hours during the day. We require an adequate air supply and the maintenance of a comfortable temperature. These two conditions may be tested by anemometer and thermometer readings. The making of these two tests is about as far as an engineer employed by a manufacturing house will go. To properly ventilate a building, requires a great deal more than that.

E. V. Hill, M.D., Chicago, says: "There must be air movement sufficient to remove the aerial envelope about the bodies of the occupants; a relative humidity of thirty-five to fifty per cent, depending upon the temperature; a bacterial content not exceeding ten colonies on a two-minute plate; a satisfactory CO_2 standard; a dust content not exceeding 100,000 particles per cubic centimeter as tested with a portable dust-counter. The air must be free from odors and the distribution of the incoming fresh air must be uniform. The room must be free from objectionable drafts."

These requirements may be met either by the installation of a mechanical or gravity ventilating system. This statement is made in spite of the fact that there has been considerable complaint regarding the working of both or either of these systems. Frequently, the teachers will complain to the board of the very unsatisfactory condition of the air in the room even though the ventilating system is supposed to be in operation. When complaints of this kind are brought to the attention of the board it would be well to have tests made so that proper arrangement for the ventilation of the room may be provided.

163. GRAVITY VENTILATING.—A gravity system is more difficult to design than is the plenum or vacuum system, and all of these systems have their staunch advocates. The writer has visited many schools for the purpose of examining the ventilating plans and has found that where gravity systems have been installed to provide for the most unfavorable as well as favorable conditions, these systems work well. Much greater flue area must be provided for gravity systems than for either of the other two systems mentioned. The area of the gravity flues must be reduced by dampers as the weather grows colder, otherwise a greater volume of air will be passed through the

Digitized by Google

building than may be required. The flues designed for a plenum or vacuum system cannot be used for the gravity system as they are too small.

164. DIRECT-INDIRECT.—In this system, certain radiators in the room are of the direct-indirect type. These direct-indirect radiators are placed on special bases, these provided with an opening for air supply from the outside. Cold air is drawn through these openings, is heated by the radiator and passes into the room. In opposite walls at about six feet from the floor-line there is placed an opening into the vent stack. There is also an opening into the vent stack at the floor line. With the direct-indirect ventilating system in a room a practical displacement of foul air is the principle worked upon, whereas with the plenum system, diffusion of the foul air to the point of comparative purity is the object aimed at.

Where the direct radiators are used in the rooms for heating purposes only, fresh air is discharged from the fresh-air flues into the room at about eight feet from the floor line. The fresh-air flues are supplied with tempered air either from the central chamber or from chambers placed at the base of the stack. (In the gravity ventilating system, it is necessary that these radiators be placed at the base of the stack so as to eliminate the necessity of having long horizontal flues.) The general arrangements of the fresh-air flues in reference to the foul-air exhaust from the class rooms is primarily the same with the gravity as with the plenum system. The foul air escapes from the room at the floor line into the vent shaft. There should also be an opening in the vent shaft at about seven feet from the floor line. This is to be tightly closed during winter, and is used only for ventilating purposes during the summer when it is desirable that the ventilation be secured to a certain extent by means of open windows.

The principal defect in gravity systems is due to the fault of no provision being generally made for summer ventilation. It is well known that the movement of air in a closed room is different in the summer from the movement in winter. It is therefore necessary that provision be made for this either by the arrangement of special window ventilation or by the extraction of the foul air from the building by way of heated flues.

If there is a direct extraction of foul air, the vent flues should have an opening about seven feet from the floor line. This should be fitted with a damper so that it may be closed during the winter months. The windows should have drafts boards just above the stools, so that the air entering by way of the windows will not cause uncomfortable drafts.

165. HOT BLAST.—In the hot-blast heating system, the radiators are placed in a casing under each window with openings in top and bottom of the casing. The air is drawn from the outside into a primary heating chamber where it is heated to a temperature of 50 or 60 degrees. It is then driven through a system of ducts to each of these radiator stacks under the windows, and in passing over these radiators it becomes heated to the temperature required to offset the cooling effects of the windows, etc. There is an arrangement of dampers at each radiator so that the temperature of the incoming

Digitized by Google

fresh air can be controlled by mixing with the tempered air at the base of the radiator. In some cases the air is exhausted from the room on the inside wall opposite to these radiators in the same manner as the gravity system of direct-indirect, and in other cases the air is exhausted from the room through an opening on the same side of the room as that on which the radiators are placed.

It has been generally found that with hot-blast systems, where air is driven into the room on the warm side of the building, there is an unsatisfactory standard of temperature maintained at different parts of the room. For instance, along the inside walls it may be seventy-five degrees while over at the windows it may be as low as sixty. Generally, with a hot-blast system, the safest principle to follow is to drive the warm air up in front of the windows.

166. UNIT SYSTEM.—Modern schools are using the unit system for heating and ventilating. By this method the air for ventilation is taken direct into the unit through an intake extending through the outside wall or a wall inclosing a fresh-air chamber. The fresh cold air is then heated to the required temperature by means of steam radiation, which is a part of the unit, and diffused throughout the room by means of specially-constructed fans propelled by small motors that are installed in each machine. A proper-sized vent or vents placed at the floor line leading into air flues extending through the roof provides the required circulation. The advocates of this system assert: (*a*) That the distribution of air to the various rooms is a positive action not affected by outside conditions, and thus overcomes one of the principal weaknesses of any other system of ventilation. (*b*) That the positive action of the fans, located right at the seat of operation, causes a much better diffusion of the air throughout the room, resulting in an evener temperature. (*c*) That the cost of installing this system is considerably less than the "central fan" or "split system" method of heating and ventilating when arranged for in the beginning by the architect, and when the space saved throughout the rooms and in the basement of the building by abolishing the many air pipes, ducts, flues, and warming air-rooms necessary for ventilating by other systems is taken into consideration. (*d*) That the cost of operation is much less because the fans in the units of the class rooms are used only for operating, thus relieving the "pull" on the boiler in every room not in use. That the electrical current required to run the various motors and the motor-generator is less than the current required for the operation of the one or two large motors driving the large fan or fans located in the basement. (*e*) That this system is much more sanitary, doing away, as it does, with all long, uncleanable, intake pipes, ducts and underground channels, which at best are catchalls for all kinds of dust, dirt and germs, and which in most installations are impossible to clean or purify. There are two general types of units—the "nonrecirculating" and the "recirculating." In the nonrecirculating type the intake damper is usually regulated by a hand-control located in or about the unit, and the air is taken only from the

Digitized by Google

outside. In the recirculating type the air may be taken either from the outside or from the room.

The intake and recirculating dampers are usually connected in this type in such a manner that when one closes, the other opens, and vice versa. This operation in some makes is regulated by a thermostatic control, in which the intake damper closes, shutting off the cold outside air, and the recirculating damper opens, allowing the air in the room to recirculate through the unit, thus utilizing the heat produced by the radiator in the unit to help raise the temperature to the degree desired. This method is particularly favored because of the aid it gives the fireman in getting the building up to the required temperature in the morning before the class rooms are occupied, and the saving of the "drain" on the boiler during the day whenever the occupants are dismissed for a short period of time. Often a thermostat is installed in these units which regulates the mixing damper, giving complete control of the temperature of the room at all times. The automatic control of the three dampers in the recirculating unit makes an ideal installation, making the system almost independent of all thought and attention by the teacher and janitor. There are three general methods of installing these units: In one, the unit is equipped with just enough radiation to raise the air required to the temperature of the room, all the heat requirements being taken care of by direct radiation; in another, the unit contains enough radiation to take care of from twenty to sixty per cent of the heating requirements, the balance being provided for by auxiliary radiation; and in the third method, the unit takes care of both the heating and ventilating. Each method has certain advantages over the others, and the choice should be guided by location and particular local conditions. The unit system of heating and ventilation is now being used by some of our largest cities for schools in this, our own State.

167. FANS.—In school work, and in fact in all buildings, fans should be large enough to run at a comparatively low speed consistent with proper pressure conditions, so that the noise of the fan will be reduced to a minimum. If the fan is placed on a well-insulated base and kept free from walls, etc., with the galvanized iron ducts leading from the fan connected to it by a flexible duct, there will be little noise in the building. Where fans are installed, and are not giving satisfaction, it is generally due to the fan being so small that it must be run at an excessive speed.

168. MECHANICALLY-DRIVEN FAN SYSTEMS.—The ventilation of nearly all large school buildings is effected by use of fans, either installed so as to work on the plenum or vacuum principle, or as a combination of both of these. In simple words, the plenum system is the "blow through," whereas the vacuum system is the "draw through." The vacuum system is more suitable for small buildings, and in the larger buildings for all toilet rooms, domestic science and chemical laboratories.

Where a plenum fan is installed the amount of air handled can be accurately measured and carefully heated to the desired temperature before

Digitized by Google

being driven into the room to be ventilated; the air passages are properly proportioned, with suitable inlets; and exhausts from the rooms are of proper sizes. As these exhaust ducts always lead vertically to the roof, on which, capping the ducts, are installed suitable rotating ventilators, there is no reason why this system should not meet all of the demands made on it under all conditions of weather.

The plenum principle is especially desired if a high type of rotating ventilator such as a continuous rotating fan-equipped ventilator is used. These ventilators take care of the ventilation over a large percentage of given periods (months' duration) without the assistance of a supply fan, consume no power, and require no attention beyond an annual oiling.

169. AIR CHANNELS.—The fresh-air ducts should be placed in such position that they can be readily inspected. They must be kept clean and the fresh-air supply must be taken from a point sufficiently remote from dust and dirt. If possible, it is best to take the air from the south side of the building, this air being at a higher temperature than that taken from any other side. The fresh-air room should have walls of glazed brick or some other material of like nature.

170. HUMIDITY.—It is claimed and with good authority that in a room where the proper standard of humidity is obtained a much lower temperature can be made comfortable than when the proper proportion of vapor is not present. It is not our intention to go into this question to any extent, but we recommend that some provision be made for supplying the proper humidity to the air. In some cases this humidity can be provided for by means of spray pipes placed in front of the heating coils in the ventilating chamber. In districts where there is much smoke and dust it will be necessary to provide an air washer. Humidifiers must be equipped with humidostats. Otherwise, precipitation will occur in the rooms and the excessive humidity makes for a great deal of discomfort.

171. VENTILATION BY ROOF VENTILATORS.—Roof ventilators are such an essential fixture of buildings that ninety-nine and nine tenths per cent of all structures in the United States, of any type or for any purpose, have roof ventilators installed whether built during the last half century or last month. In recent years, rapid improvements have been made in the perfecting of this ventilating apparatus, and now most buildings, including schools, are depending entirely upon roof ventilators for ventilation, and for schools of moderate size they are considered most satisfactory. The rotary fan-equipped-type ventilator is the highest developed, is wind-propelled, and so constructed as to be ninety-nine per cent constant in New York and neighboring States, as is proven by United States Weather Bureau wind reports. The ventilator is greatly aided by the always-prevailing temperature difference between the inside of the building and the outer air, as it exhausts via vertical ducts through the roof.

172. THERMOSTATS.—Automatic control of the temperature of the class rooms is greatly to be desired, and where the funds will permit of a complete

Digitized by Google

installation an automatic heat-controlling system should be used. But here is one point where the board cannot attempt to economize by eliminating certain features that are absolutely necessary, and unless the funds are sufficient to cover not only the control of the radiators in the class rooms but also the individual control of the fresh-air supply to each room, money is thrown away in attempting to install an automatic temperature-controlling system. The control of the radiators should be on the thermostat controlling the fresh-air supply because it is manifestly impossible to control the temperature of a room on the south side of a building and other rooms on the northern side of the building when there is only one thermostat controlling the temperature of air for the whole building.

If the thermostat is set at seventy-five degrees at the heater stack; figuring that air will enter the room at seventy degrees, a room on the south side of the building with the air entering at this temperature will be too hot, and it may be impossible to raise the temperature of the room on the northern side by the radiators alone while the ventilating system is in service.

173. Air Filters.—In most districts where school buildings are to be located today, the amount of dust and soot in the air is so excessive as to make imperative the need for some means of providing clean air in the ventilation system of these buildings. The fact that this dust invariably carries with it bacteria and other micro-organisms adds greatly to the necessity for eliminating it from the school rooms. The solution of the problem has not been easily accomplished. If a piece of equipment cleaned the air well, it was apt to clog up quickly and offer such difficulties in cleaning as to make its use questionable; or it might remove dust and fail to touch particles of soot. The maintenance and upkeep, cost of water and of replacements might make the installation prohibitive for the average school. The problem has been successfully attacked in recent years by the development of the viscous impinging type of air filter. In a few years this air filter has so thoroughly demonstrated its ability to provide clean air at low cost, and also its perfect dependability, that it is in extensive use not only in schools but in other buildings. These filters are based on a different principle from other equipment for the purpose. An installation is made up of a number of units according to the capacity required. The fan or blower of the regulation ventilating system is the only motive power required for the filters, and since it is an indispensable adjunct of mechanical ventilation, it cannot properly be considered as part of the filtration system. Each unit consists of a filter cell and frame about twenty by twenty by four inches over all. Cells and frames of all units are completely interchangeable. The capacity of a unit is about eight hundred cubic feet per minute. The filter cell contains a series of baffles in the form of specially-shaped and perforated sheets of metal which are coated with a nonevaporating, noninflammable, viscous and sticky fluid. As dusty air passes through the cell it is forced to change its direction innumerable times while the velocity of the many subcurrents of air passing through the cells, causes dust and soot particles to impinge

Digitized by Google

against the sticky surfaces of the filter sheets where they stick and are held. Only clean air passes through. This constant baffling action makes it possible to provide large and unobstructed passages in the metal baffle sheets as well as to allow plenty of room between each sheet, to avoid clogging, and so build up a resistance to the air currents. It is easily seen that the screening principle does not enter into this type of air filter and that increasing resistance by clogging is not possible. Cleaning and recharging of these filters is required, but this is the only operating and upkeep expense involved. Cleaning is carried on in a semi-continuous sequence—a cell at a time. Starting with any dirty cell, it is removed from the installation and immediately replaced with a spare clean, charged cell. The dirty cell is moved vigorously up and down two or three times in the wash tank provided for the purpose which contains a solution of hot water with a little soda. The dust and soot come out easily on account of the ample openings in the filter medium. The cell is then drained on the rack, and when dry is dipped into the viscous fluid in a charging tank also provided which is similar to the washing tank. Set aside on the rack to drain, it serves as a spare cell for the next cleaning. The entire operation of cleaning and recharging takes only three minutes. On the average installation, a cell is cleaned about once every other day. Thus, the average school janitor can easily attend to the installation in a negligible part of his time. Since the dust and soot are so easily washed out and there are no meshes to clog with dirt, there is no tendency in these filters to build up resistance with successive cleanings. Obviously, since no water is used, these filters do not affect humidity at all. Where humidification is necessary, the logical solution of the problem is to provide for a humidifier to operate in addition to the air filter. Combined equipment for a washing and humidifying system uses so much water for air cleaning that it overworks the humidifying function, and so while of doubtful cleaning efficiency, adds excessive moisture to the air particles in the warm months when this is not needed.

THE BOILER

174. A volume might be written on the heating boiler alone. There are so many things to be considered that a lifetime study would not place us in a position where we could learn all there is to know about this particular apparatus. Heating-boiler manufacturers spend much time and money in experimenting and in an endeavor to increase the efficiency of the boiler that they are offering to the public; and with this they have proved the existence of certain guiding principles of boiler construction that can safely be followed. It is well known that the more things are specialized for certain purposes, the less efficient they become under favorable conditions. We may take, for instance, the construction that breaks up the hot gases in small currents so that every available heat unit is extracted from the fuel. Now, that construction itself is a very good feature, but if a boiler built on this principle should be connected to anything but a high flue, its small flue areas would in a short time become so choked with soot that its very merit would

Digitized by Google

become a fault. This is an example of how points of excellence under a wrong condition will lead to annoyance.

Perhaps it may be well to refer to the ratings of heating boilers before mentioning any of this type of apparatus now on the market. When a boiler is rated with a capacity of four thousand square feet of direct cast-iron radiation, it is meant that the boiler is capable of extracting from the fuel the number of heat units that can be thrown off a like amount of radiation in a still body of air at seventy degrees above the Fahrenheit zero. One hundred square feet of direct cast-iron radiation generally throws off as much heat as may be taken up by six square feet of heating surface. One of the things that should always be taken into account when estimating the capacity of heating boilers is their grate area. While different forms of heating surface require different proportions of grate area, a safe rule to follow is to select a boiler that has a grate area equal to at least one square foot for every two hundred feet of cast-iron radiator surface or its equivalent.

This rule is based on the consumption of six pounds of anthracite coal per square foot of grate per hour. In some of the large sizes of boilers the ratings are based on a consumption of eight pounds of coal per square foot; and it may be said that, with proper firing, these boilers will develop their full rated capacities; but as most heating boilers are fired in a careless manner, it is not safe to figure for a much higher combustion than six pounds of coal per hour per square foot of grate.

Remember that boilers are rated to supply a certain amount of heat at their outlets, only, and that a factor must be allowed for the loss of heat occasioned by the distance that the heat must travel from the boilers to the radiators. An allowance of from twenty to forty per cent of the net radiation should be added to the actual load, to provide for this necessity. Boilers used with hot-water or steam-heating systems are of the following types:

(1) The horizontal return tubular boiler—a brick-set boiler. (2) The fire-box boiler—either brick-set or portable. These may be made of cast iron or of steel. (3) Sectional boilers in vertical or horizontal sections. These may be of cast iron or of steel.

The horizontal tubular boiler may be used where soft coal or wood is the best available fuel. This type of boiler is sometimes used by engineers for hot-blast systems of heating. The brick setting should be built only by capable mechanics, and the setting should be examined at frequent intervals for the purpose of discovering and repairing any air leaks.

The fire-box boilers are of the horizontal tubular type and also of the cast-iron sectional type, having the entire fire box surrounded by a water jacket. This type of boiler requires a lower ceiling height than does the return tubular boiler. It can be used for almost any kind of fuel with the exception of the smaller grades of anthracite.

The greater number of boilers used for heating purposes are those of the cast-iron sectional type. There are many varieties of this type on the market, differing principally in the direction of gas travel. An extended description of the different types would take up a great deal of space, and

Digitized by Google

as manufacturers' catalogues, as a rule, contain complete descriptions of particular types, we will simply note those things that should be looked for in a good boiler:

First.—There should be few joints exposed to direct action of the fire. Second.—All parts should be easily cleaned. Third.—The fire box should be large enough to permit of proper combustion. Fourth.—If the boiler is to have the constant attention of a fireman, or if it is to be of the self-feeding type, the grate area should be large and thin fires should be maintained. In all cases the fire pot should be deep so that a large body of fuel may be fed at a time. Fifth.—Boilers should contain sufficient water so that the filling. of radiators with steam will not greatly lower the water line of the boiler. Although it is a fact that boilers with a small amount of water space will steam quickly, the boiler containing a large amount of water will keep up steam longer. Before selecting a boiler we should be able to answer the following questions: What kind of fuel is the easiest to obtain? Is the building in a residential district where soft coal may be a nuisance? What heating surface is required? Is the building to be kept at the same temperature all of the time or is heat required for only a few hours each day? What kind of janitor service may we reasonably expect? How about room for the boiler? There are may more questions that might be taken up before a boiler is selected, yet we believe that we have pointed to the principal phases of the subject, and those which should be of some value to the members of a school board when they are considering the installation of boilers.

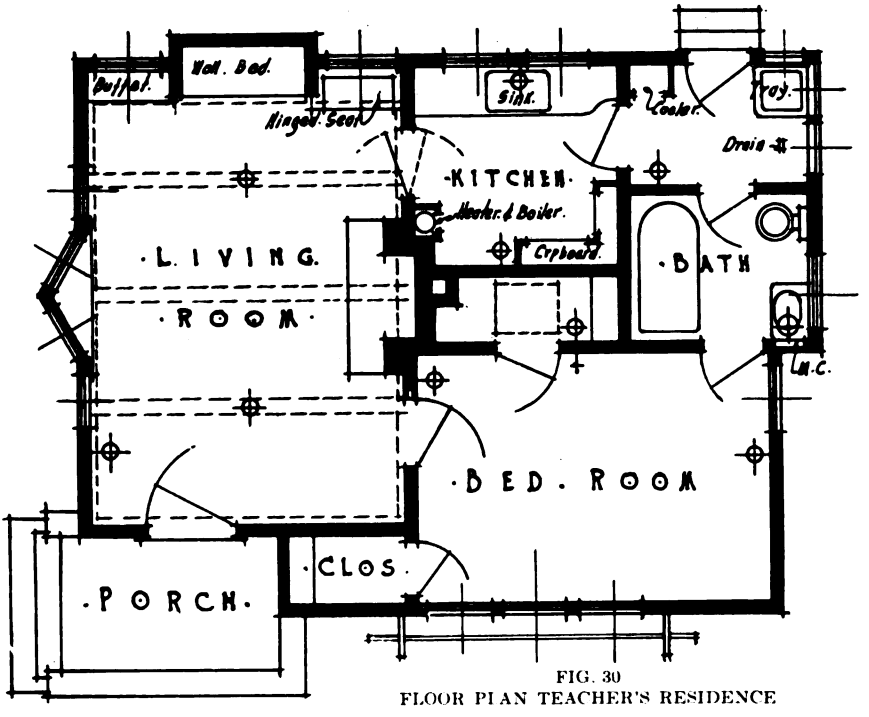


FIG. 30
FLOOR PLAN TEACHER'S RESIDENCE

Digitized by Google

TEACHERS' RESIDENCES

175. The teacher's residence has become an important feature in the administration of rural schools because the people take a decided interest in it. They feel that the teacher's presence has a marked influence upon the community and that this influence is broadened and strengthened when the teacher lives in a model dwelling and works under the most wholesome conditions. There are many good reasons why such residences should be provided in our rural districts. In a great many cases a young woman teacher is forced to board and share her room with a daughter in the family, where heat is lacking in winter and where no opportunity is provided for self-improvement or study. If good teachers are to be secured and retained, some effort on the part of school boards should be taken to see that they are comfortably housed.

CONSOLIDATED SCHOOLS

176. History of Consolidated Schools.—This bulletin does not permit of a lengthy discussion of consolidated schools. A few facts may therefore suffice: Consolidation was introduced in New England more than forty years ago because of the gradual exodus to the cities and the West.

Children have been conveyed to school at public expense in the Atlantic Coast States since 1869. The system is now operative to a greater or less extent in forty-six States, and some in the Middle West have almost put an end to the small school. Thus, Ohio has hundreds of consolidated schools. Indiana heads the list with more than six hundred, and Michigan, Illinois, Iowa, Nebraska and Minnesota are all making good headway. Kansas has nearly two hundred. North Dakota has one hundred ninety. Oklahoma, although a new State, has had a substantial growth in consolidated schools. Westward—Utah, Idaho, Colorado, Washington and other States have many excellent consolidated schools. Nor is the South any less active. All Southern States have consolidated schools and transportation of children. Clear down to Florida we find them. In Louisiana, whole counties have every school consolidated. This is all the history necesasry, and consolidation has proven wonderfully successful in most of these States.

177. Relation to the Rural Life Movement.—The consolidated school takes its name from the fact that its establishment was originally due to the union of two or more school districts, that two or more teachers were employed in the same school building, and that, in consequence, academic work done in these schools was of a better character than that previously done in the little district school taught by one teacher. Our industrial life is experiencing fundamental changes. The phenomenal growth of cities has been coincident everywhere with growth in manufacturing industries. These have produced modern labor-saving machinery for the farm, and have consequently reduced the demand for farm labor. Local industries have died and rural craftsmen have flocked to the cities. Worst of all, untold numbers of farm youth, without whom the rural communities will languish, are drawn

Digitized by Google

thither by the glamor of the city life and its opportunities for advancement. The drift of country population, which had its beginning in economic causes, subsequently was continued with increased momentum from purely social reasons.

The crude, though virile school of pioneer days, with its man teacher and many pupils has passed away. In its place is the small, poorly-taught and poorly-supported school of the average community. Careful investigation shows that the old-time lyceum and spelling bee, the neighborhood singing school and debating society have had their day, and no modern substitute is offered.

Country life has gradually become shorn of its human satisfactions, where such were at one time known. People are moving to town because the rural school does not offer the spiritual uplift demanded by the human soul. Social life there, too, does not fill the craving for recreation and diversions of normal human beings. Country life as a whole must be reconstructed or redirected. It is now altogether too much dependent on the city life. Many factors must have a share in this change for the better; but none, certainly, can play so great a role in the movement as the new farm school.

Life in rural districts is agricultural. The new school must offer an agricultural education, i.e., must give expression first to good scientific farming, rendering ample requirements for the labor expended and, secondly, to a rural social life satisfactory to those living it. Such tasks are beyond the old school. The strong, consolidated school alone can solve them.

178. THE CONSOLIDATED SCHOOL CENTER.—The new kind of school becomes the natural center of all community enterprise. Wherever consolidated schools spring up, there community undertakings seem to flourish. The very things for which country folk come to town can now be obtained at home. The school, to begin with, is better for farm purposes than any offered in town; for with it comes the impluses necessary to organize a community on a more permanent social and economic basis.

Let the school have a large assembly hall to be used for extension lecture courses, neighborhood social gatherings, farmers' institutes, boys' and girls' clubs, mothers' meetings, polling places, etc. The same buses bringing the children to school at public expense are used in some places to convey the parents to many of these meetings. That is perfectly right. For let us bear in mind: THE TASK OF THE NEW SCHOOL IS NOT LIMITED TO THE CHILDREN IN THE SCHOOL; IT REACHES INTO THE FARM HOME AND SEEKS TO BE HELPFUL THERE. ITS TASK IS TO MAKE COUNTRY LIFE MORE SCIENTIFIC AND THE PEOPLE MORE CONTENTED.

179. THE SCHOOL STRUCTURE.—The school structure should be built as a permanent school plant, having a large assembly hall, well-equipped class rooms, and agricultural laboratory. The basement is of incalculable benefit to the community, since advanced ideas in education have made it

Digitized by Google

more than a coalhole and a repository for all the trash and junk that accumulate during the year. Instead of being a catchall, the basement now serves as the workshop for the boys who have adopted vocational training as a part of their work. The girls, too, utilize the basement for their sewing and cooking rooms. The vocational training departments of consolidated schools have proven popular innovations, and are, it is believed, largely responsible for the increased interest in general school work. Children who once desired to discontinue study, now seek to continue through the higher courses. No steps should be taken towards building until after a consultation with educational experts, and then plans and specifications should be prepared by a competent schoolhouse architect.

180. THE PLANS.—The ideal way to plan a rural school is to employ a schoolhouse architect. That means an architect who knows the rural problem in its educational, industrial, social and sanitary aspects. He is worth the fee he asks, when one considers that in order to plan the schoolhouse properly he must view the site and design a building in harmony with the natural surroundings or with such landscape transformation as may be considered desirable. The time required for such a survey, as well as for a study of features which should be incorporated in the building, is always considerable. The drafting of sketches to allow the school board some choice should also be given consideration. Taking it all in all, this very desirable method is almost certain to prove most economical, eventually.

181. SCIENTIFIC AGRICULTURE.—The study of scientific agriculture has taken a strong hold. Admirable results have been secured in the vocational training departments. It has been found that the boys, in studying and working at the trades in school, carry their newly-discovered skill home and use it with good effect around the house and barn. They want to repair everything that is in any way imperfect. Naturally, the parents and hired hands and the grown-up brothers catch the spirit of interest, and help to place the neglected machinery and buildings back on a working basis. The girls, with their sewing and cooking classes, have also worked some effective reforms. Their experiments in domestic science are carried home, and the mothers, at first doubtful because of previous prejudices, soon find themselves interested in the new ideas on household economics, and willingly set aside the old humdrum methods of home maintenance. The result is that the whole atmosphere of the place is sweetened and life takes on a brighter glow. Now, fathers sit at home on winter nights and take a delight in going over the lessons with the children, not only to help them but also to absorb some of the information themselves.

Once the consolidated school is established, its worth is immediately proven. Not one of the schools that was abandoned when a consolidated school was opened, has been reopened. The consolidated school has injected new life into rural schools. In athletics, the country boy used to be content with an occasional game of ball or pitching horseshoes. To-day, the increased number of boys attending the consolidated schools have basketball, football,

Digitized by Google

baseball, track meets and all the open-air thrills. Athletics in the rural school have had a marked influence in checking the flow of the human tide towards the cities. Country boys are beginning to realize that at home they have practically every advantage known to the city youth and, as added capital, the wonderful effects of life in the open. It has been found that backward pupils, through the agency of athletics, music, and other diversions, have been brought to enjoy quickened pulses and enlivened mentality.

The consolidated school is a community pride builder. Farmers who had opposed good roads and displayed their general lack of pride in the appearance of their houses and barns have been converted through the advent of the enlarged rural school.

First of all, the school needs goods roads in order that the buses may operate in all kinds of weather. The rural mail carrier also made a demand for better roads. Sometimes the big, new consolidated school building looks like a diamond set in a sea of mud. The roads simply have to be improved. The question of improved highways edges its way into all rural conversations. Somehow it creeps in where two or more farmers are gathered together at the village store, around the blacksmith shop, or before or after church. Stories of how the bus stuck in the mud burns its way into the very conscience of the community. Something has to be done. Then comes the good roads meeting at the new schoolhouse. The result of the agitation has been that to-day the country is on the high tide of good-road building. The improved roads and the new schoolhouse are pointed to with pride.

Men and women who said that the district school was good enough for them and should be good enough for their children, came to the conclusion that nothing was too good for a community that had enough energy to seek better things in life.

The improvement of the highways has completely altered the early experiences of the township trustees and the busmen who convey the children to and from school. With good roads the busman is able to run his bus on a schedule like that used for railways. Mothers know that the bus will be along at 8:12 a.m., and they have their children ready. The teachers know that the bus will arrive at the school at 8:45, and they are there ready for the day's work. Busmen are held responsible for the delays, and the entire order of the day's school business is carried on systematically. Good roads make punctuality possible.

182. Community Spirit.—It is not advisable to attempt consolidation in districts where community spirit is at a low ebb. Community spirit is the first requisite. A reasonable degree of it is absolutely essential before beginning the work. A few men and women with the right kind of outlook can do much to inspire a community, and in time even the most conservative neighborhood may be ready for the new system. In many places, consolidation is the result of slow but positive growth; in others, it is almost spontaneous. Where the latter is the case, there are sure to be many people

Digitized by Google

who have permitted personal prejudice to drop, for the greater good of community union. The first thing to ascertain, then, is whether or not the area under consideration has the spirit to work together for the good of all. That is more important than good roads, for with it all obstacles will be surmounted or at least minimized.

183. Local Conditions.—The leaders in the movement must make a careful study of local conditions. The proposed district must not be too large. No transportation should be for more than five miles. Nor should the district be very small. A small district will not contain taxable property enough to run a good school without making a levy unbearably high. The topography of the land plays an important role. The worst hills, sticky roads, and most frequently flooded lowlands should be avoided; at least, in laying out the transportation routes. Matters of school enrollment, condition of schoolhouses, rates of taxation necessary for school maintenance, etc., must be considered.

184. Size and Value of District.—The preliminary survey of the field should be based on these conditions: (1) The proposed district should show a school enrollment of two hundred or, if attached to a village, at least one hundred and fifty. At least two hundred must be shown in a district of twelve square miles before the open country should undertake the organization with village privileges. (2) There should be a total taxable valuation of at least $300,000; a little less will do in some cases. From $350,000 to $400,000 is much better. These figures are intended chiefly for districts contemplating free conveyance of pupils.

185. Campaign of Education.—(1) There must be a preliminary canvass, suggested above, to ascertain the feeling in the community. Any public-spirited man or set of men can do this.

(2) Such a canvass should be followed up by a publicity campaign. The men who have undertaken to lead the movement should send to the University of the State of New York for bulletins from which to clip and compile enough material to make a fair, concise statement of facts. This should then be printed and put into the hands of the voters in the proposed district.

(3) After all have had time to study the question, public meetings should be held. To these should be invited experts from the University of the State of New York. Such meetings will offer opportunity for the discussion of many things not clear to the average voter.

(4) As a last step, the campaign must be carried into every district within the proposed consolidation. An excellent idea is to give at least one lecture (illustrated if possible) in every schoolhouse.

Consolidation has become more favorably fixed in the minds of the people, until now opposition to it is considered a thing of the past. Looking backward upon these years of experience it can safely be said that consolidation has accomplished among other things the following:—

(1) Established a deeper confidence in the school—man's most vitalizing agency.

Digitized by Google

(2) Brought first-class schools to the country pupils and overcome the necessity of country pupils leaving their homes to go to city schools.

(3) Made homes in the country more desirable and thereby raised the value of real estate.

(4) Erased boundary lines, and worked for the common good of all people.

(5) Stimulated the "getting-together" habit.

(6) Introduced the "transportation idea" and supplied means of travel.

(7) Caused, and is causing, better roads to be built.

(8) Equalized taxation for school purposes and the advantages which result therefrom.

(9) Provided more funds for school purposes.

(10) Expended school money more judiciously.

(11) Awakened a keener interest in school elections, through non-partisan, as in general elections.

(12) Eliminated a multiplication of district trustees of but ordinary qualifications.

(13) Created in their place a board of education, consisting of five very competent members.

(14) Abandoned poor, isolated buildings.

(15) Erected new, modern, central school buildings with improved lighting, heating and ventilating systems.

(16) Furnished these buildings with large halls, tinted walls, and ample blackboards; and equipped them with pianos, phonographs, single desks, work tables and other durable furniture, as well as adequate apparatus, material and supplies.

(17) Kept these buildings in first-class condition.

(18) Expanded school grounds to a size which encourages organized outdoor play and the planting of school gardens.

(19) Graded these grounds, put down cement walks, and installed sanitary drinking fountains.

(20) Sought the assistance of the ablest students in rural education which the country affords.

(21) Introduced a high quality of school supervision.

(22) Employed expert supervisors in primary methods, music, art, physical education, manual training, agriculture and household science and domestic arts.

(23) Raised the standard of efficiency on the whole teaching force.

(24) Retained special help in work with delinquent pupils, and engaged the services of trained nurses to examine each pupil at least once a week.

(25) Held a liberal number of male teachers in the grade schools, most of whom are making teaching their life's work.

(26) Put fewer pupils with each teacher, thereby giving the pupils more personal attention.

Digitized by Google

(27) Resulted in a larger enrollment.

(28) Increased the percentage in daily attendance of this increased enrollment.

(29) Increased the percentage of promotion in this increased enrollment.

(30) Added at least an average of ten days' attendance per pupil per year.

(31) Reduced the percentage of failures and retentions more than one third.

(32) Overcome, to a considerable extent, the tendency to quit school before graduating.

(33) Made a standard rural school possible.

(34) Inspired a high percentage of pupils of the elementary junior to attend high school.

(35) Reduced truancy to a minimum.

(36) Improved the classification and grading of the school.

(37) Brought parents and adults closer to the real interests of the children.

(38) Obtained the good will and co-operation of its patrons.

(39) Economized the time of pupils, teachers and patrons.

(40) Overcome local prejudices; made the remote country child associate with children of other localities, giving him a broader view and extending his circle of friends and acquaintances.

(41) Created social centers, with their libraries, literary societies, business and industrial organizations, athletic associations, music and amusements.

(42) Fostered a taste for the best that life can give and enriched the lives of the people.

(43) Placed a strong class leader in every school.

(44) Aroused enthusiasm for healthful rivalry and fair competition in all school work.

(45) Made pupils progressive, content, comfortable and happy.

(46) Taught punctuality and dependability by example.

(47) Safeguarded the health of the children.

(48) Emphasized a high moral tone.

(49) Formed a better basis for the study of the school as a factor of economics and sociology.

(50) Made better school legislation necessary.

THE FLAG

186. When the flag is used out of doors it should be allowed to fly in the breeze. When clusters and draping of colors are desired, bunting or cloth should be used, but never the flag. This from "Code of Rules for Flag Etiquette," proposed by Daughters of American Revolution.

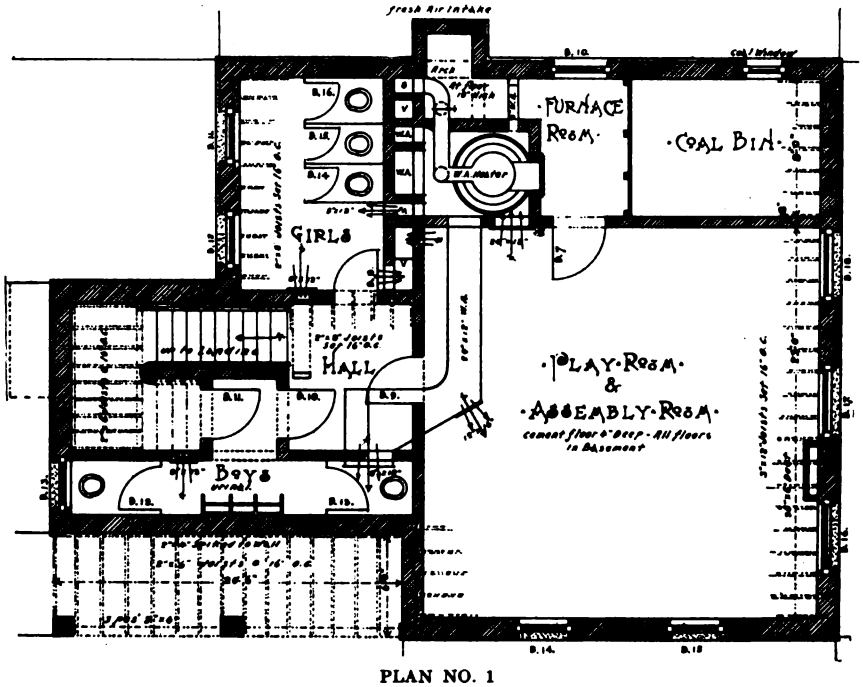
Digitized by Google

With the same underlying thought in mind, may it not be said that it is better to use the flag in the school room on a staff than to attach it in a fixed form on the wall? Clearly, the flag should be unfurled when it is saluted. Will not the exercise of saluting the flag mean much more, if some pupil as standard-bearer brings the flag on a staff before the class? When the flag is borne before the school, pupils should be as prompt to rise to their feet as if America or the Star-Spangled Banner was being played. A flag permanently attached to the wall as drapery will not be likely to develop this attitude.

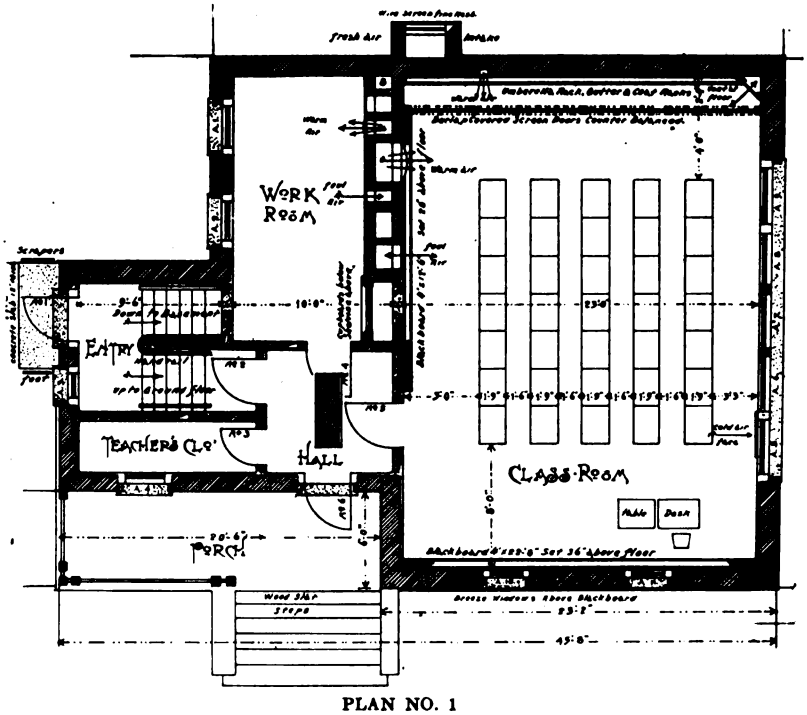
A flag draped over Washington's portrait on his birthday might be regarded an excellent way of paying tribute to the father of our country. But this flag is used for permanent decoration. Patriotic emotion should be aroused by the sight of the flag, but such lofty feelings cannot be experienced all the time. Every time the pupil in this room raises his eyes, they will rest upon the flag. Will such constant association with it tend to make it seem commonplace? The flag lessens the importance of the picture, which presumably is hung in the most conspicuous place in the room so that pupils may come to know the features and character of the man. Such a portrait should be dignified and honored by plenty of space around it.

No schoolhouse should ever be erected without providing for a flagpole either on the building or on the grounds. No day of National, State or local importance should go by without having the flag displayed.

Digitized by Google

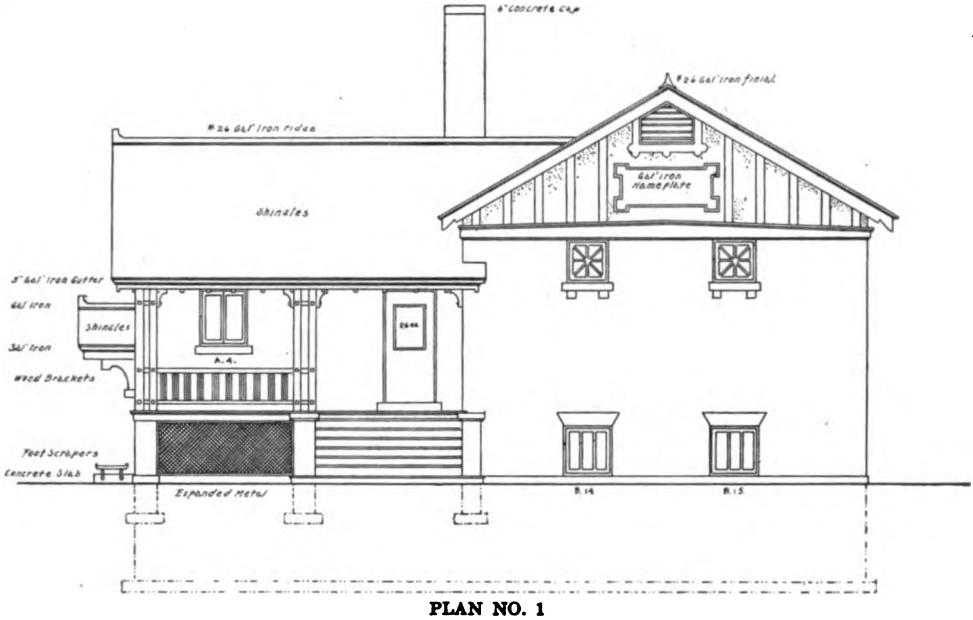


PLAN NO. 1
BASEMENT PLAN—ONE-ROOM SCHOOLHOUSE

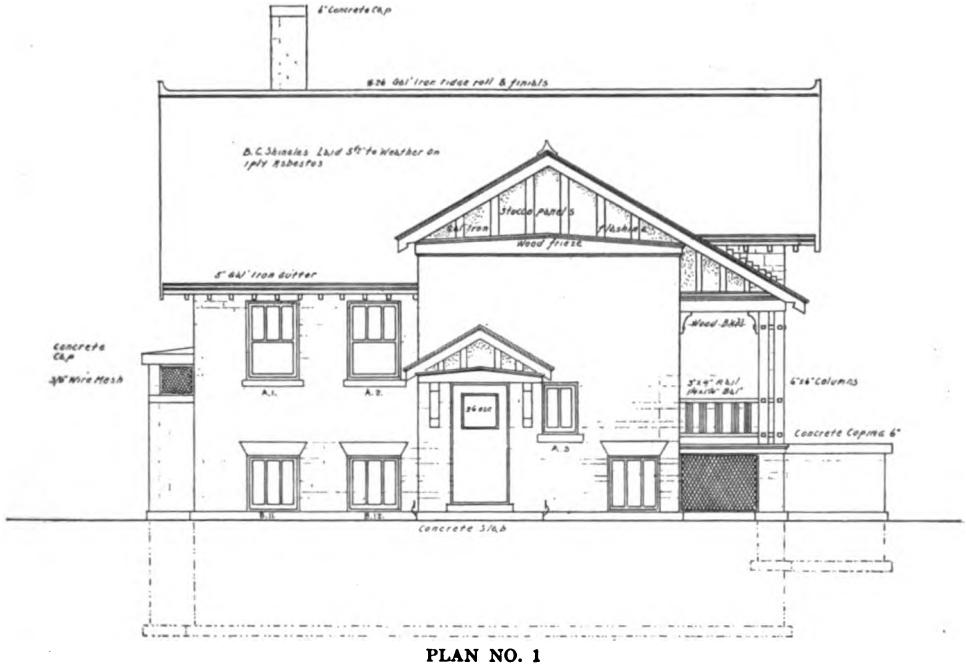


PLAN NO. 1
GROUND-FLOOR PLAN—ONE-ROOM SCHOOLHOUSE

Digitized by Google

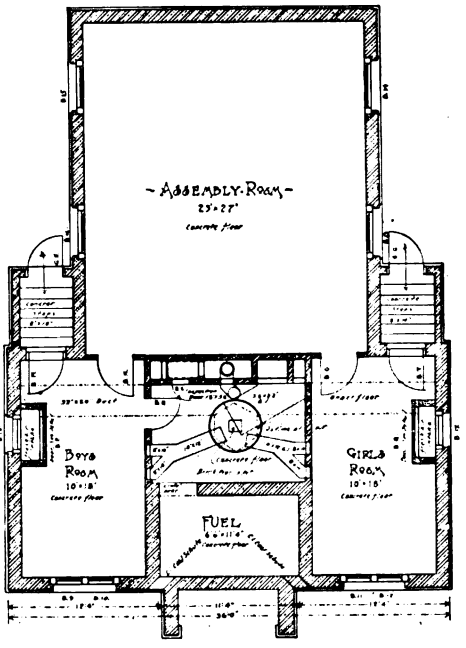


PLAN NO. 1
FRONT ELEVATION—ONE-ROOM SCHOOL-HOUSE

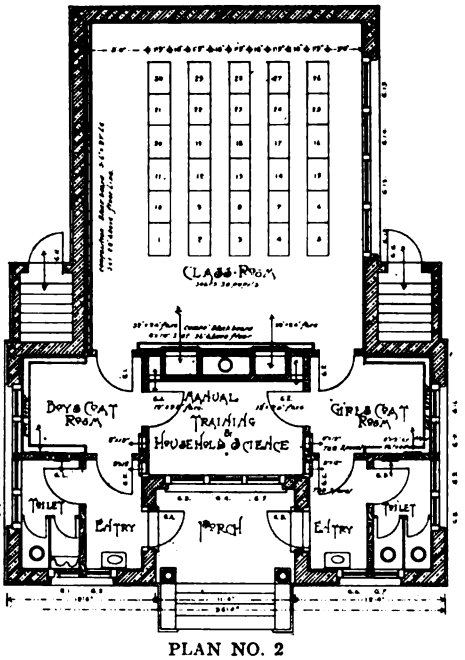


PLAN NO. 1
SIDE ELEVATION—ONE-ROOM SCHOOLHOUSE

Digitized by Google



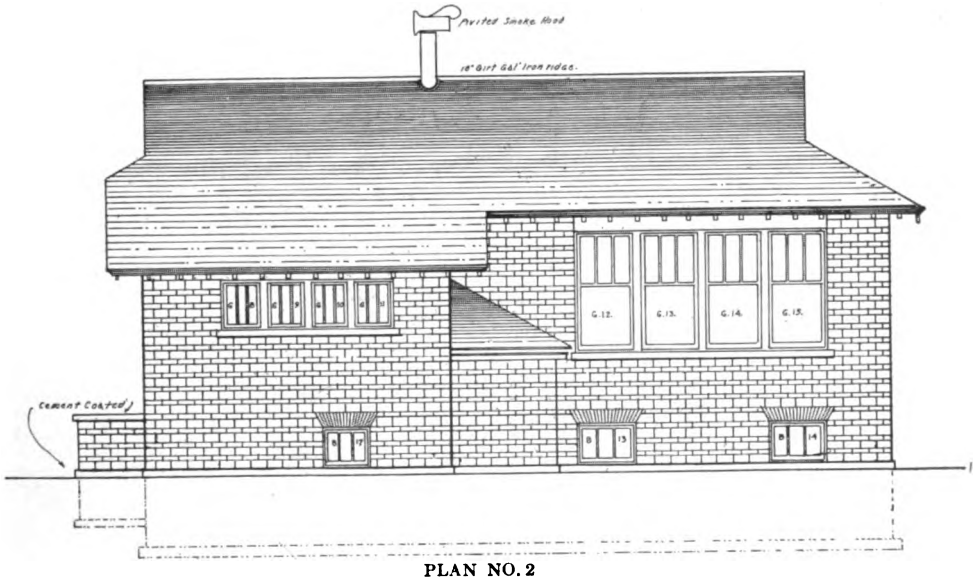
PLAN NO. 2
BASEMENT PLAN—ONE-ROOM SCHOOLHOUSE



PLAN NO. 2
GROUND-FLOOR PLAN—ONE-ROOM SCHOOLHOUSE

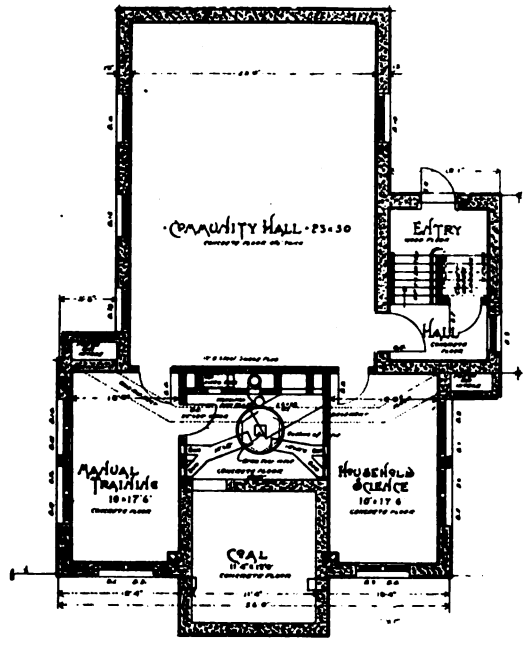
Digitized by Google

PLAN NO. 2
FRONT ELEVATION—ONE-ROOM SCHOOLHOUSE

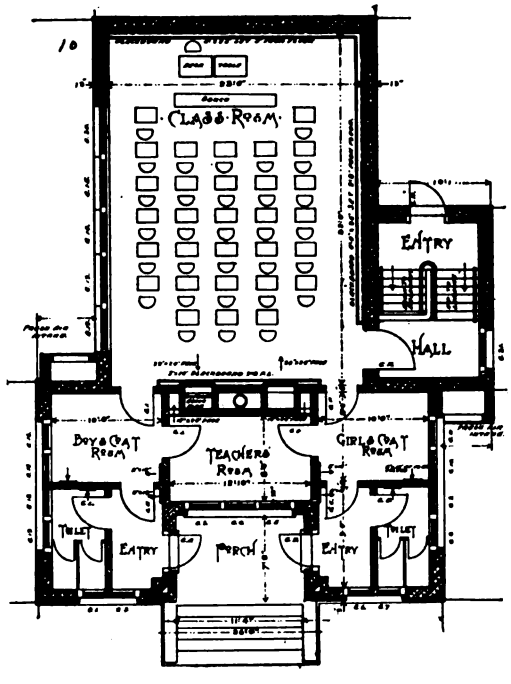


PLAN NO. 2
SIDE ELEVATION—ONE-ROOM SCHOOLHOUSE

Digitized by Google

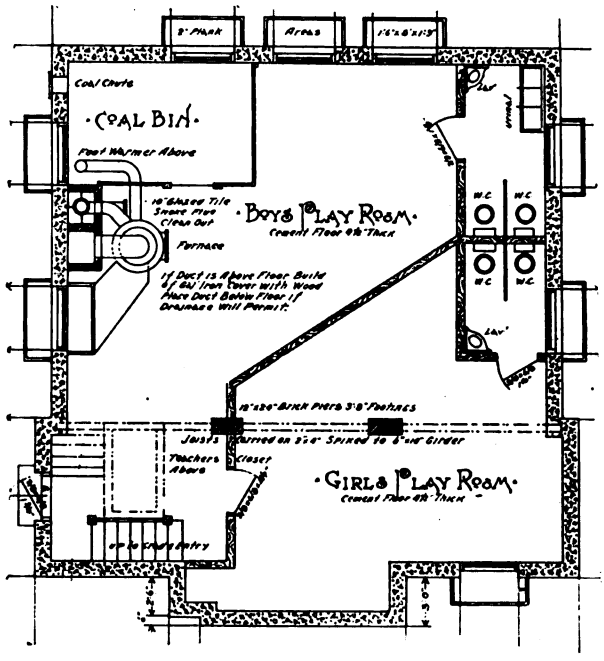


PLAN NO. 3
BASEMENT PLAN—ONE-ROOM SCHOOLHOUSE WITH COMMUNITY HALL

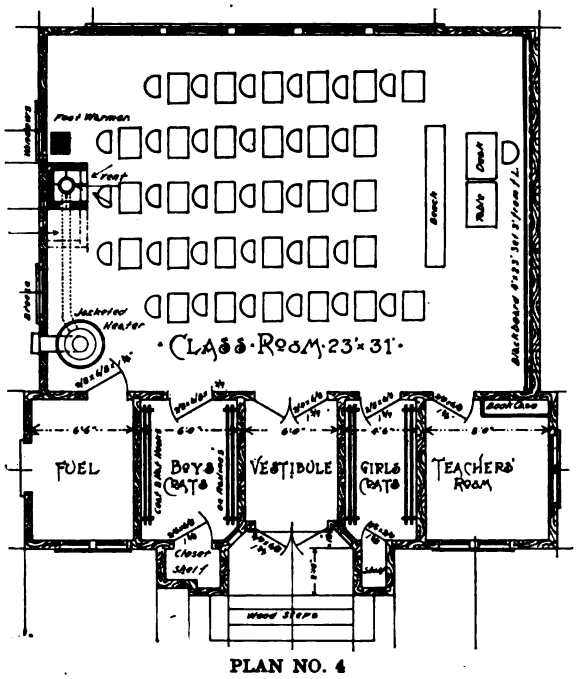


PLAN NO. 3
GROUND-FLOOR PLAN—ONE-ROOM SCHOOLHOUSE WITH COMMUNITY HALL

Digitized by Google

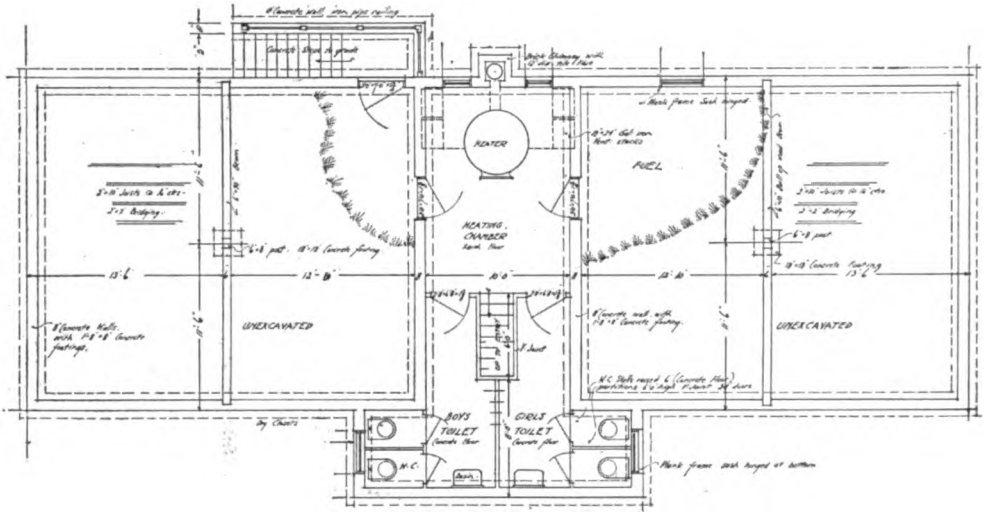


PLAN NO. 4
BASEMENT PLAN—ONE-ROOM SCHOOLHOUSE

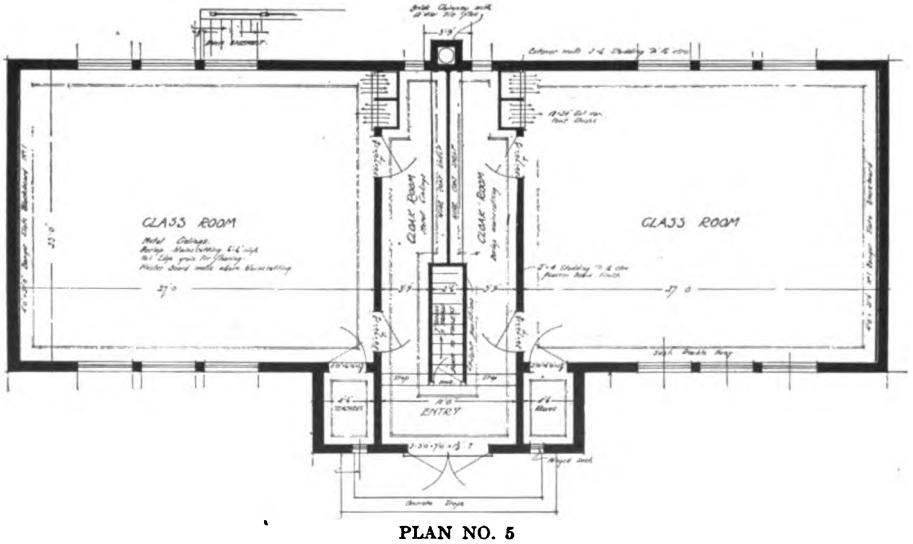


PLAN NO. 4
GROUND-FLOOR PLAN—ONE-ROOM SCHOOLHOUSE

Digitized by Google

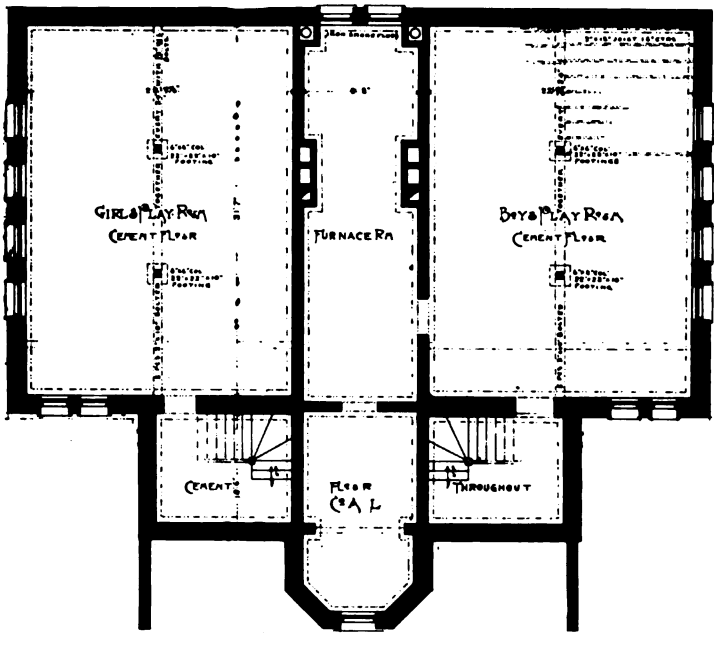


PLAN NO. 5
BASEMENT PLAN—TWO-ROOM SCHOOLHOUSE

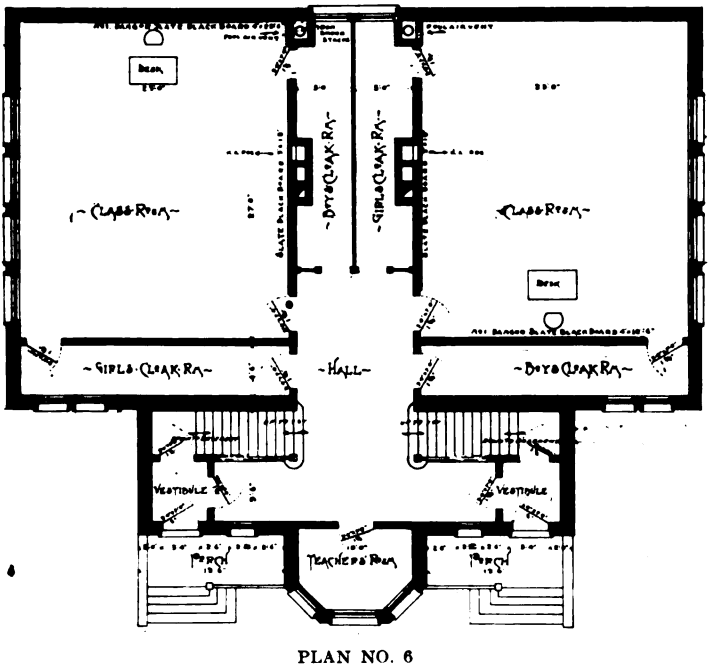


PLAN NO. 5
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE

Digitized by Google

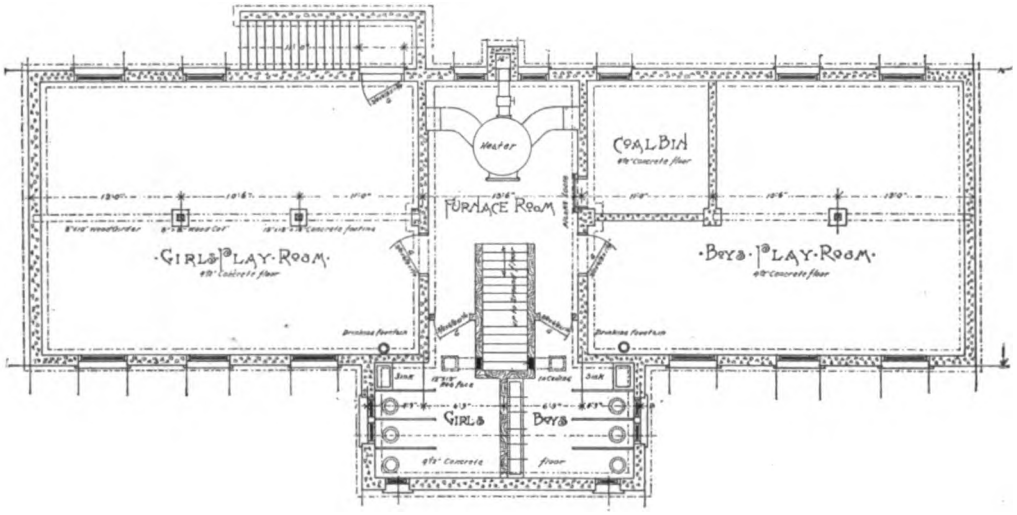


PLAN NO. 6
BASEMENT PLAN—TWO-ROOM SCHOOLHOUSE

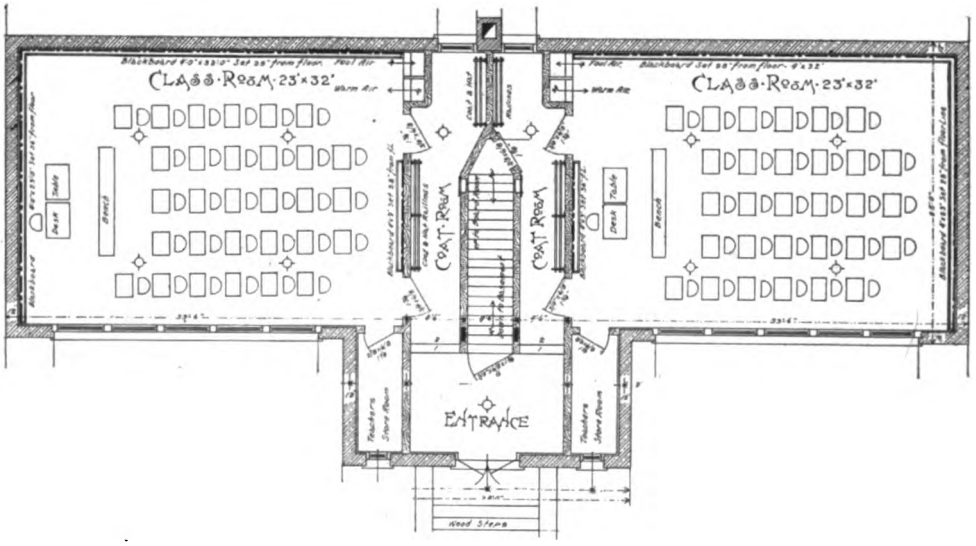


PLAN NO. 6
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE

Digitized by Google

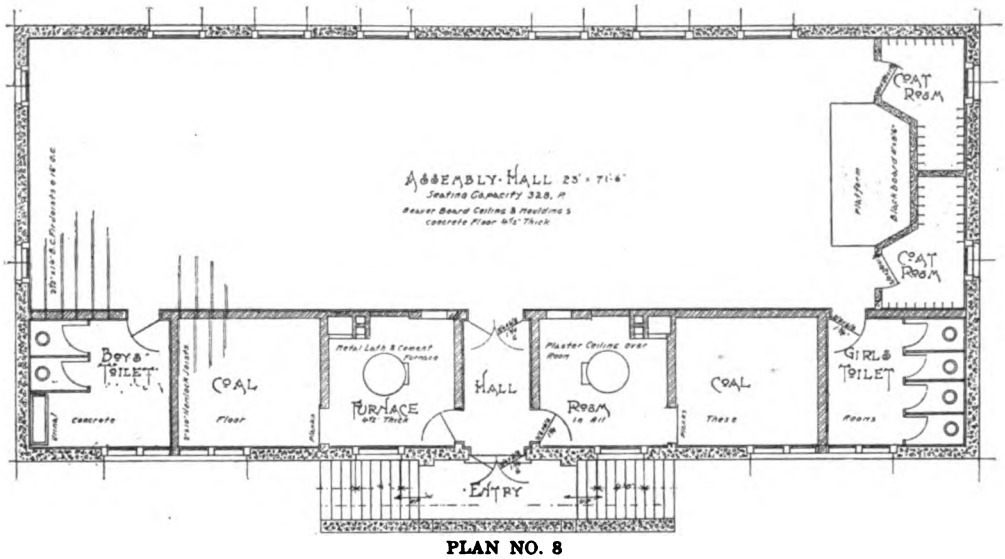


PLAN NO. 7
BASEMENT PLAN—TWO-ROOM SCHOOLHOUSE

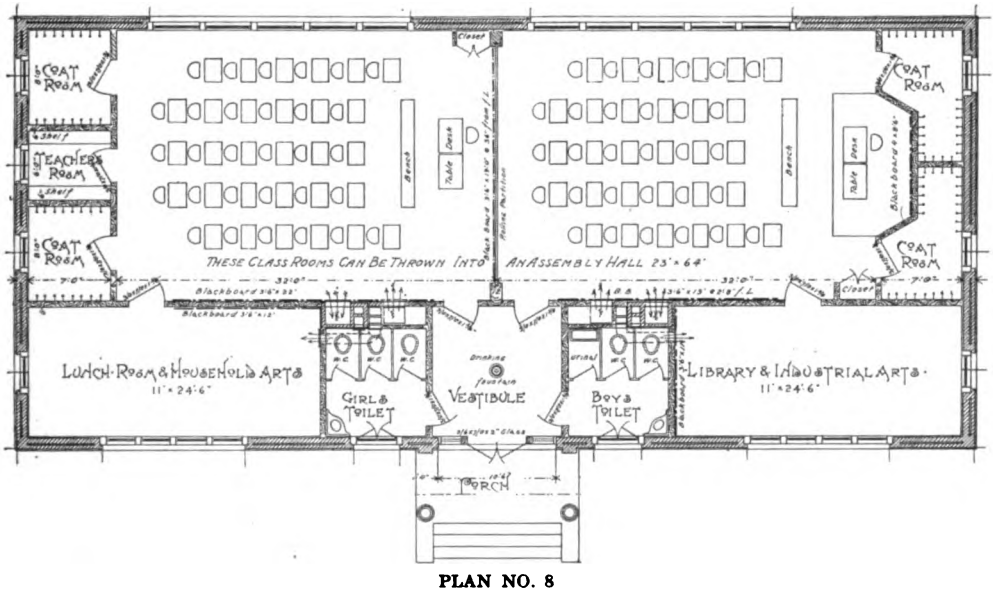


PLAN NO. 7
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE

Digitized by Google

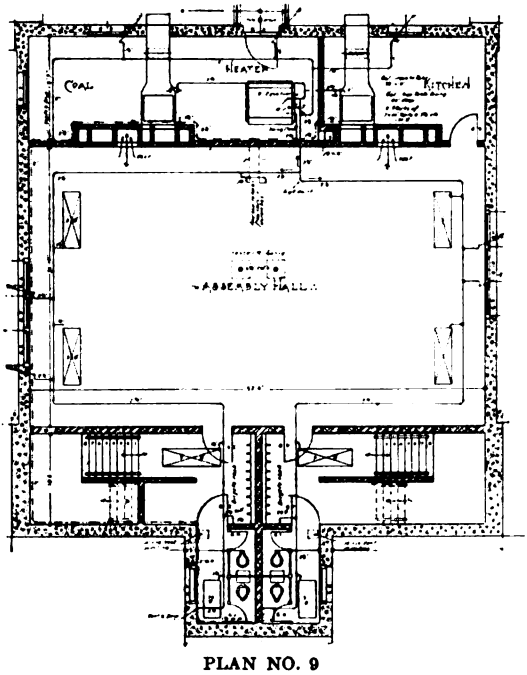


PLAN NO. 8
BASEMENT PLAN—TWO-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL

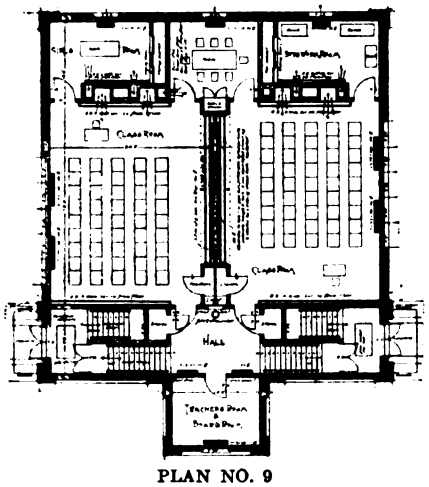


PLAN NO. 8
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE WITH HOUSEHOLD SCIENCE AND INDUSTRIAL ARTS ROOMS

Digitized by Google

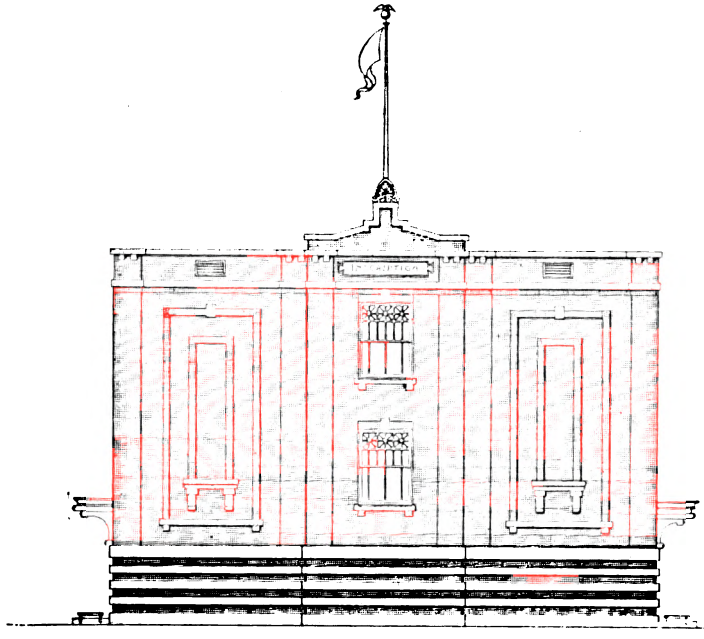


PLAN NO. 9
BASEMENT PLAN—TWO- OR FOUR-ROOM SCHOOLHOUSE WITH WORK ROOMS AND ASSEMBLY HALL

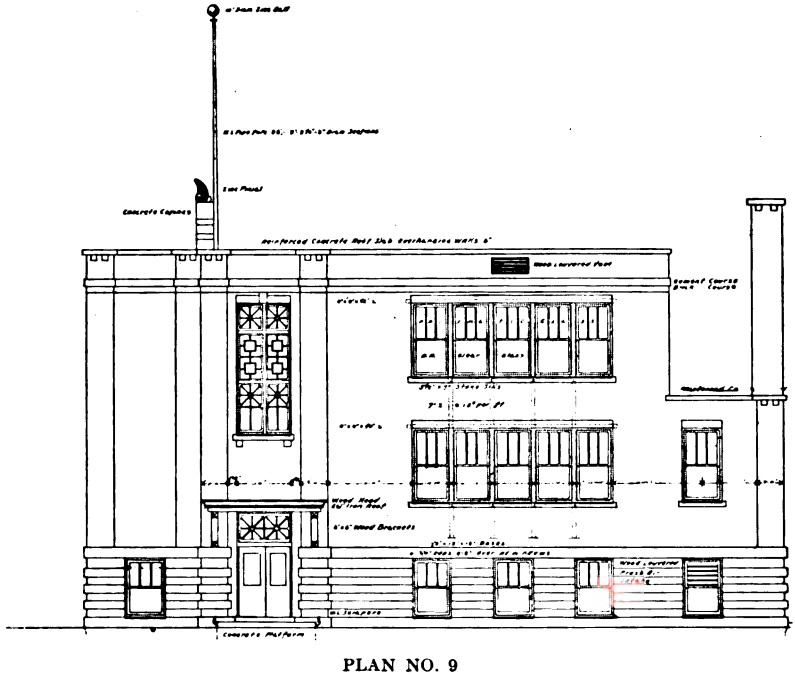


PLAN NO. 9
GROUND-FLOOR PLAN—TWO- OR FOUR-ROOM SCHOOLHOUSE WITH WORK ROOMS AND ASSEMBLY HALL

Digitized by Google

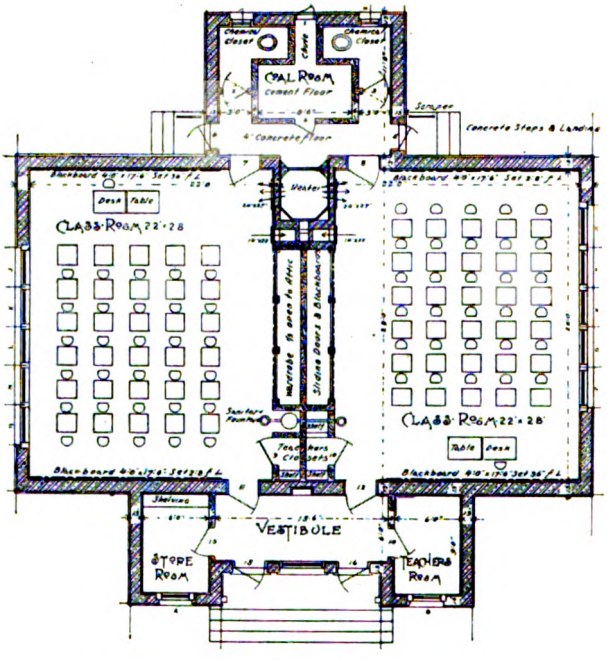


PLAN NO. 9
FRONT ELEVATION—TWO- OR FOUR-ROOM SCHOOLHOUSE WITH WORK ROOMS AND ASSEMBLY HALL

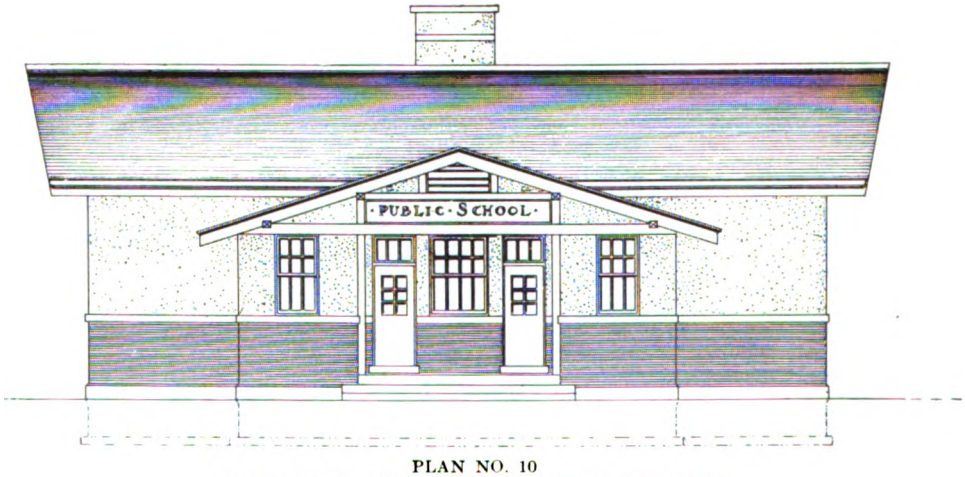


PLAN NO. 9
SIDE ELEVATION—TWO- OR FOUR-ROOM SCHOOLHOUSE WITH WORK ROOMS AND ASSEMBLY HALL

Digitized by Google

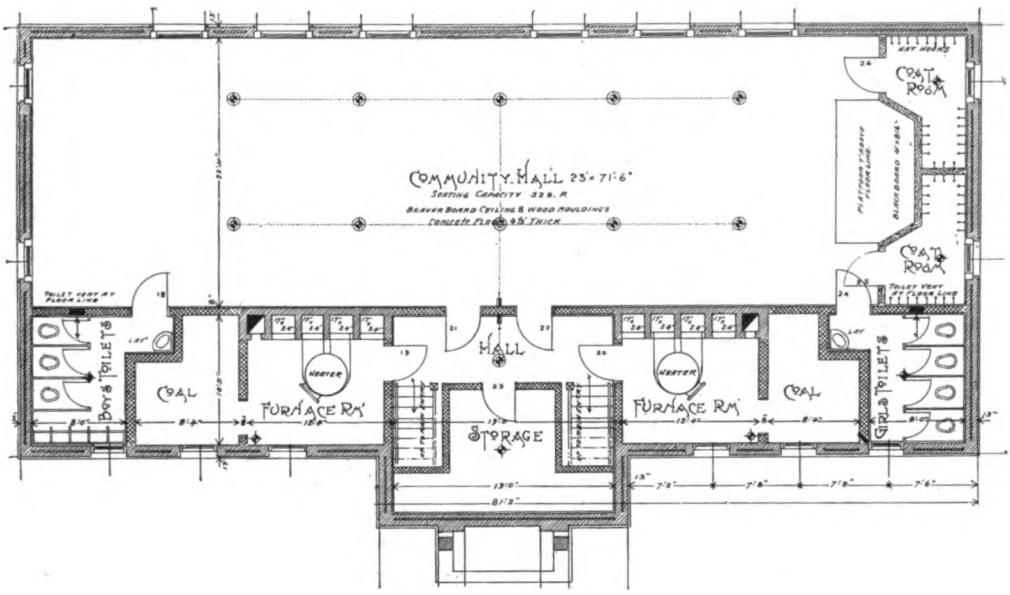


PLAN NO. 10
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE

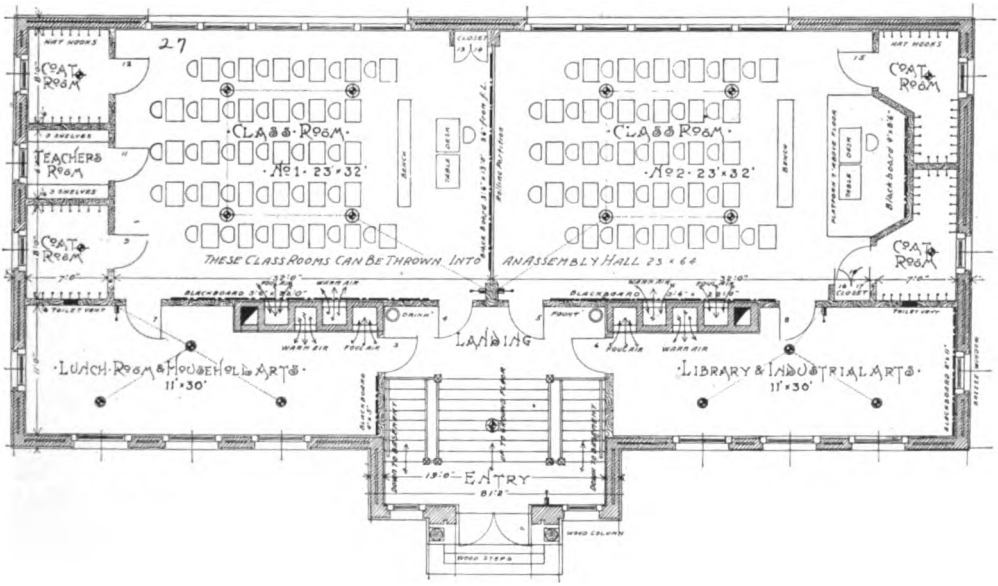


PLAN NO. 10
FRONT ELEVATION OF TWO-ROOM SCHOOLHOUSE

Digitized by Google

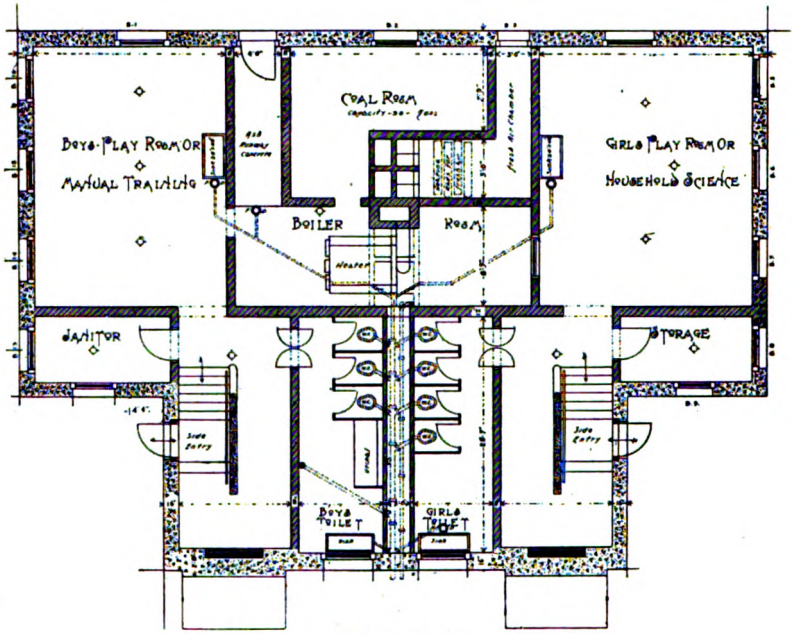


PLAN NO. 11
BASEMENT PLAN—TWO-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL, HOUSEHOLD AND INDUSTRIAL ARTS ROOMS

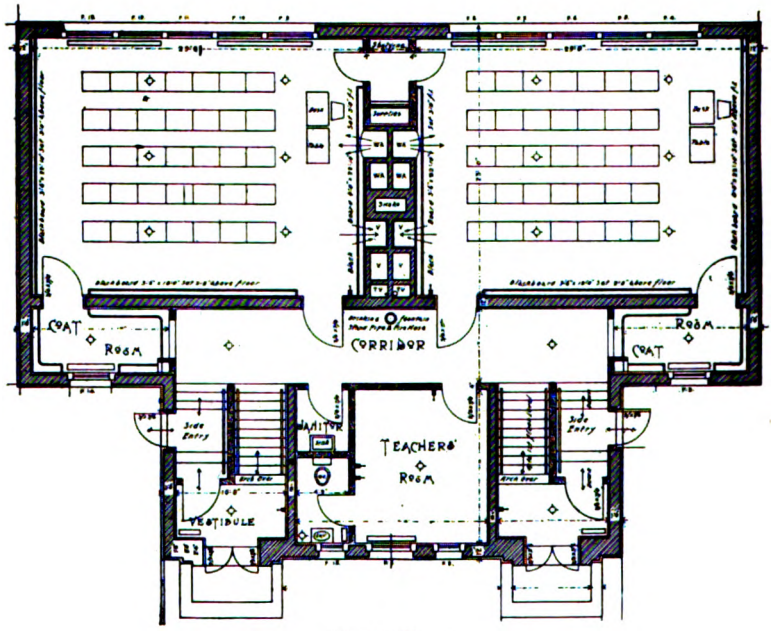


PLAN NO. 11
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL, HOUSEHOLD AND INDUSTRIAL ARTS ROOMS

Digitized by Google

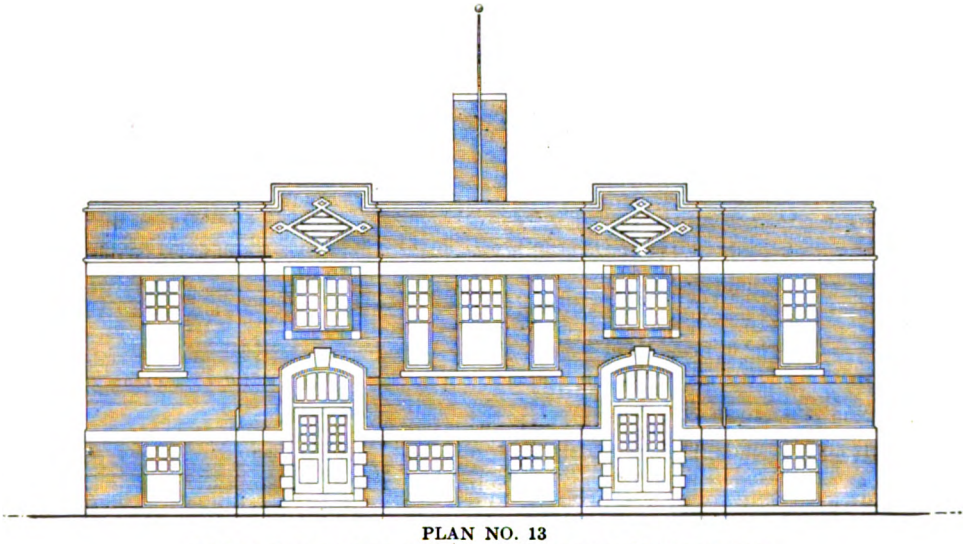


PLAN NO. 12
BASEMENT PLAN—TWO-ROOM SCHOOLHOUSE



PLAN NO. 12
GROUND-FLOOR PLAN—TWO-ROOM SCHOOLHOUSE

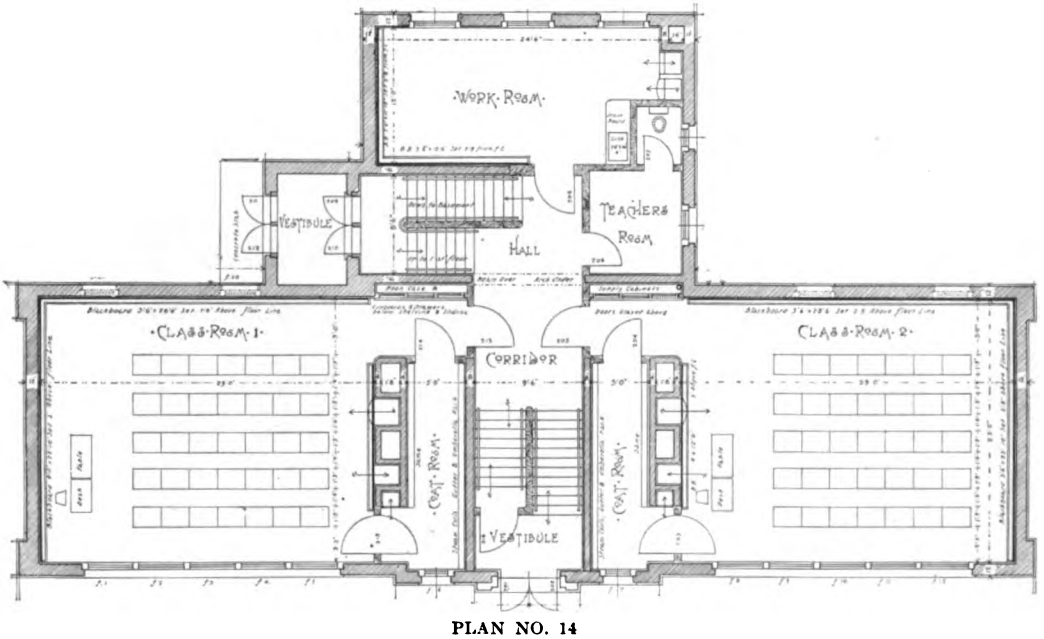
Digitized by Google



PLAN NO. 13
FRONT ELEVATION—TWO OR FOUR-ROOM SCHOOLHOUSE

PLAN NO. 13
EXTERIOR VIEW OF TWO OR FOUR-ROOM SCHOOLHOUSE

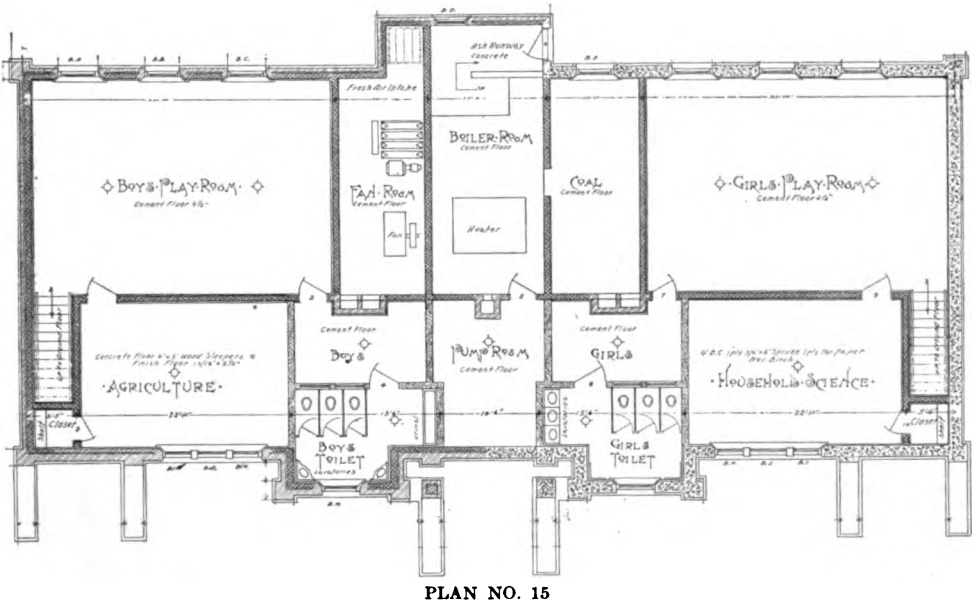
Digitized by Google



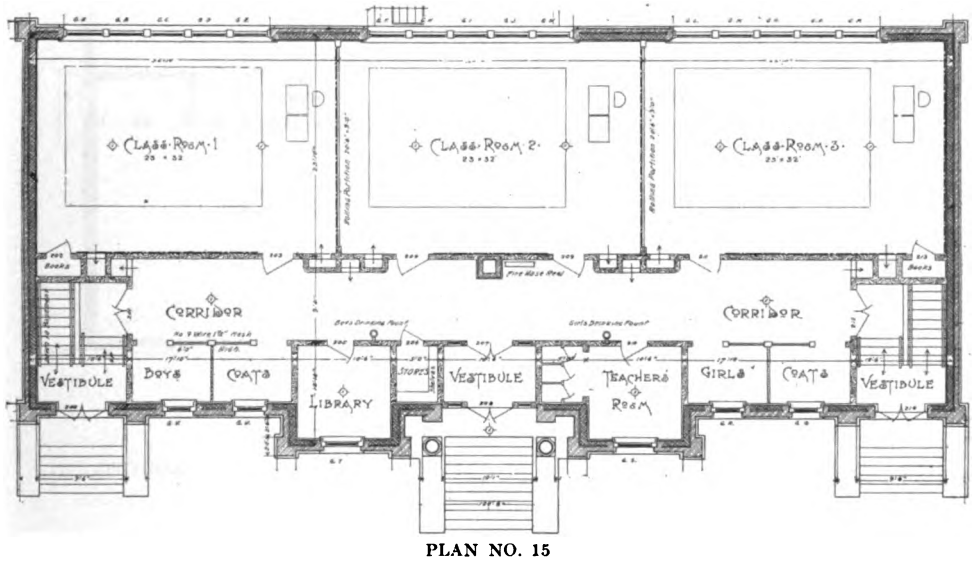
PLAN NO. 14
GROUND-FLOOR PLAN—TWO OR FOUR-ROOM SCHOOLHOUSE

PLAN NO. 14
EXTERIOR VIEW—TWO OR FOUR-ROOM SCHOOLHOUSE

Digitized by Google

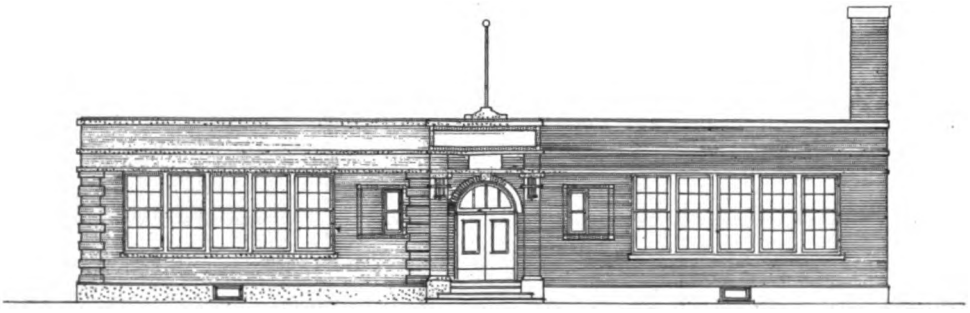


PLAN NO. 15
BASEMENT PLAN OF THREE-ROOM SCHOOLHOUSE WITH HOUSEHOLD SCIENCE AND AGRICULTURAL ROOMS

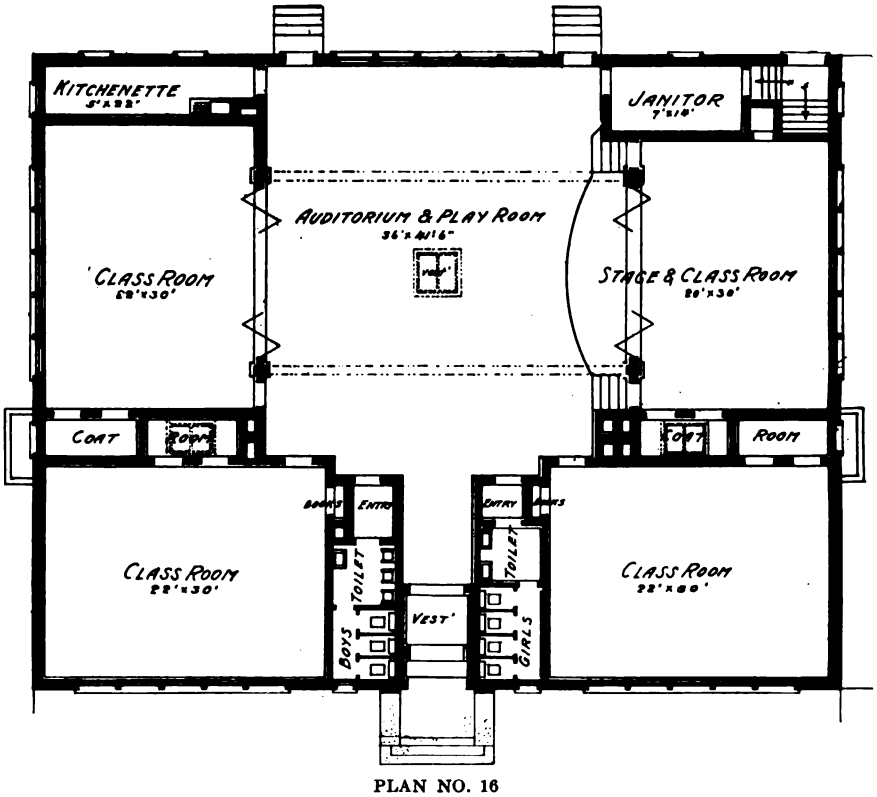


PLAN NO. 15
GROUND-FLOOR PLAN OF THREE-ROOM SCHOOLHOUSE WITH HOUSEHOLD SCIENCE AND AGRICULTURAL ROOMS

Digitized by Google

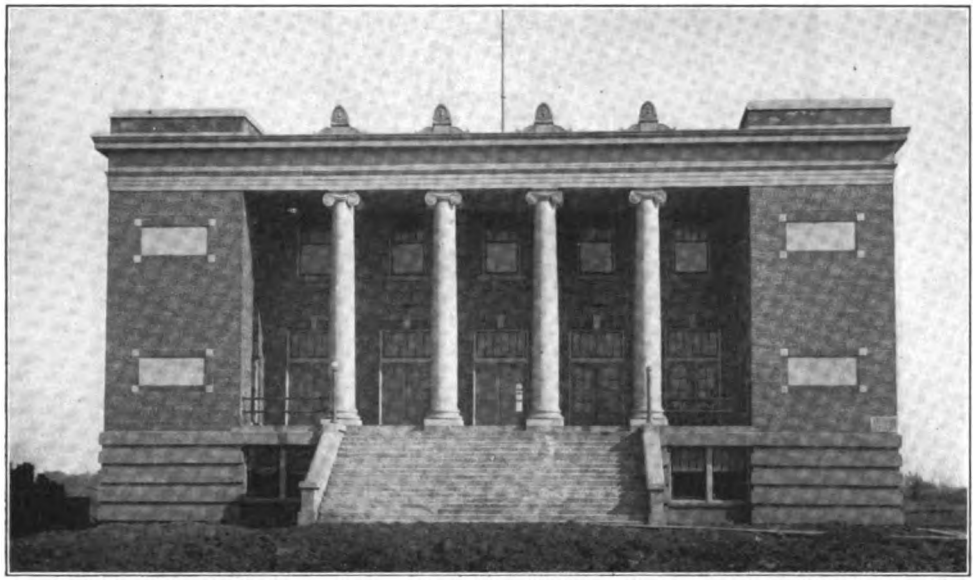


FRONT ELEVATION

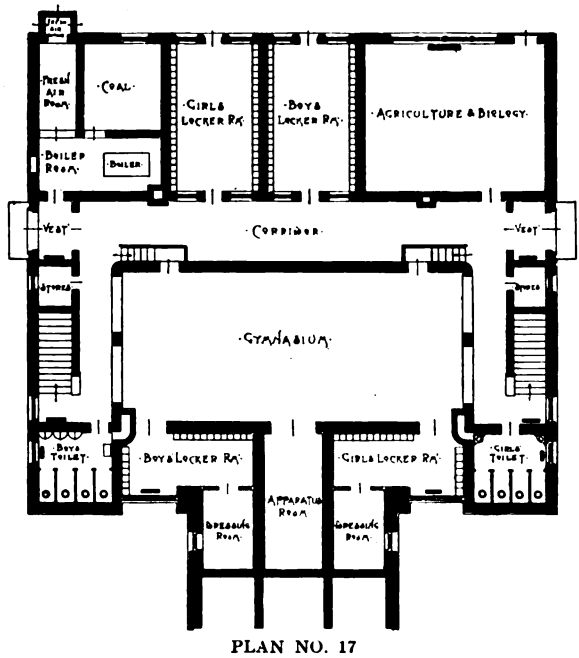


PLAN NO. 16
GROUND-FLOOR PLAN OF ONE-STORY, FOUR-ROOM SCHOOLHOUSE WITH AUDITORIUM AND PLAY ROOM

Digitized by Google

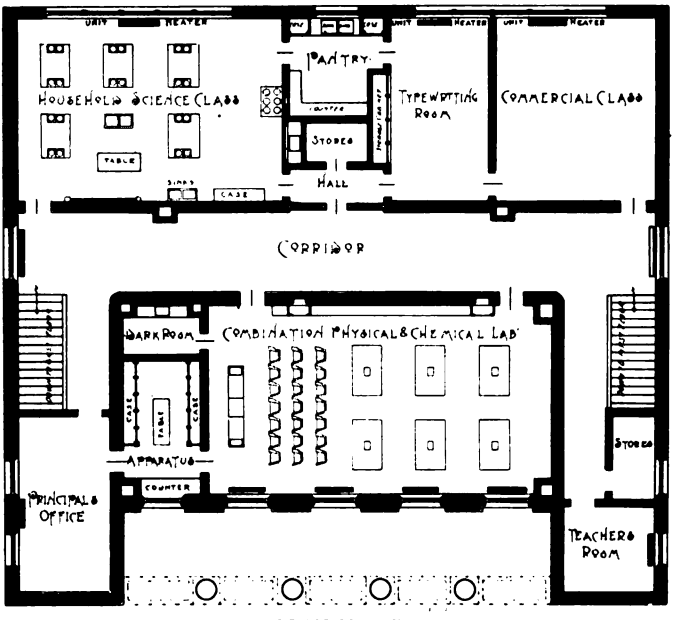


PLAN NO. 17
EXTERIOR VIEW OF RURAL HIGH SCHOOL WITH FIVE CLASS ROOMS, ASSEMBLY HALL, GYMNASIUM AND AGRICULTURAL ROOM

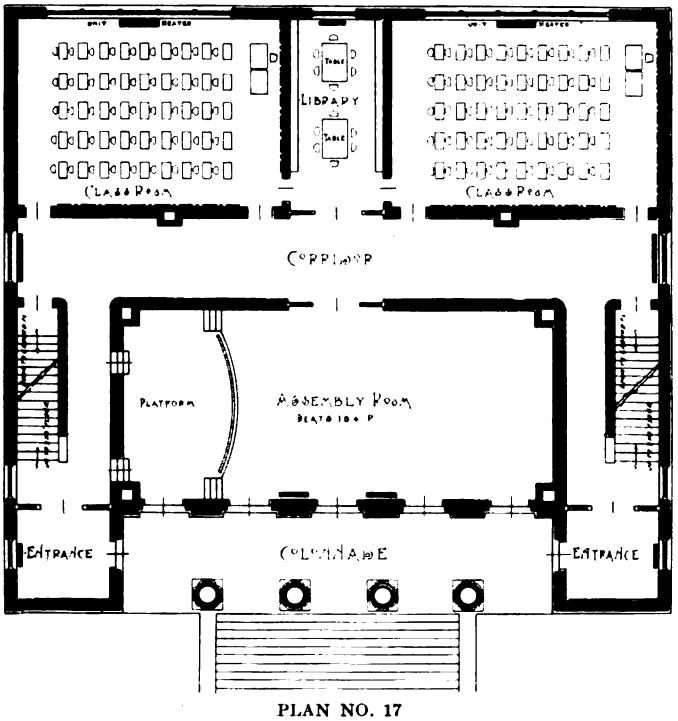


PLAN NO. 17
BASEMENT PLAN OF RURAL HIGH SCHOOL WITH FIVE CLASS ROOMS, ASSEMBLY HALL, GYMNASIUM AND AGRICULTURAL ROOM

Digitized by Google

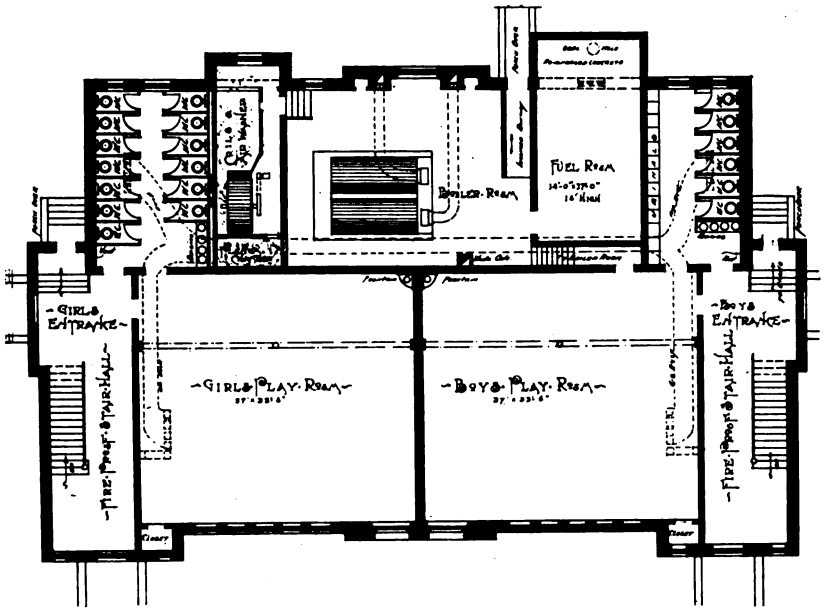


PLAN NO. 17
GROUND-FLOOR PLAN OF RURAL HIGH SCHOOL WITH FIVE CLASS ROOMS, ASSEMBLY HALL, GYMNASIUM AND AGRICULTURAL ROOM

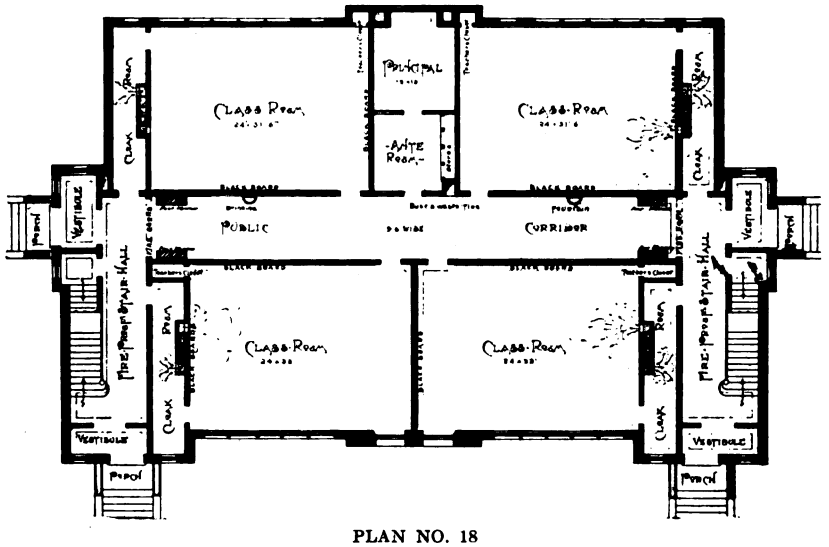


PLAN NO. 17
FIRST-FLOOR PLAN OF RURAL HIGH SCHOOL WITH FIVE CLASS ROOMS, ASSEMBLY HALL, GYMNASIUM AND AGRICULTURAL ROOM

Digitized by Google



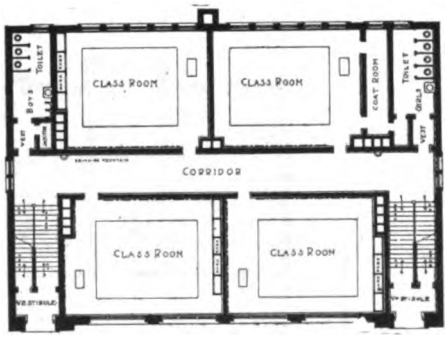
PLAN NO. 18
BASEMENT PLAN OF EIGHT-ROOM SCHOOLHOUSE



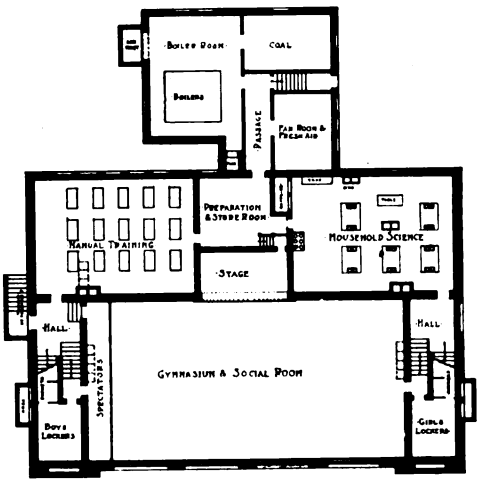
PLAN NO. 18
GROUND-FLOOR AND FIRST-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

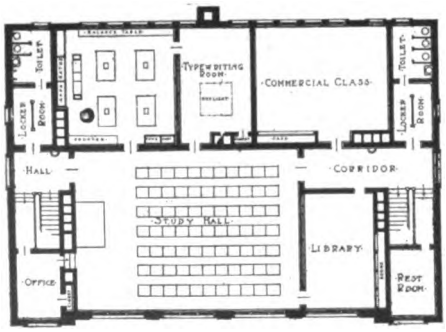
The plans illustrated show a high school containing four class rooms —commercial class, typewriting class, combination physical and chemical laboratory, and library,



PLAN NO. 19
GROUND-FLOOR PLAN



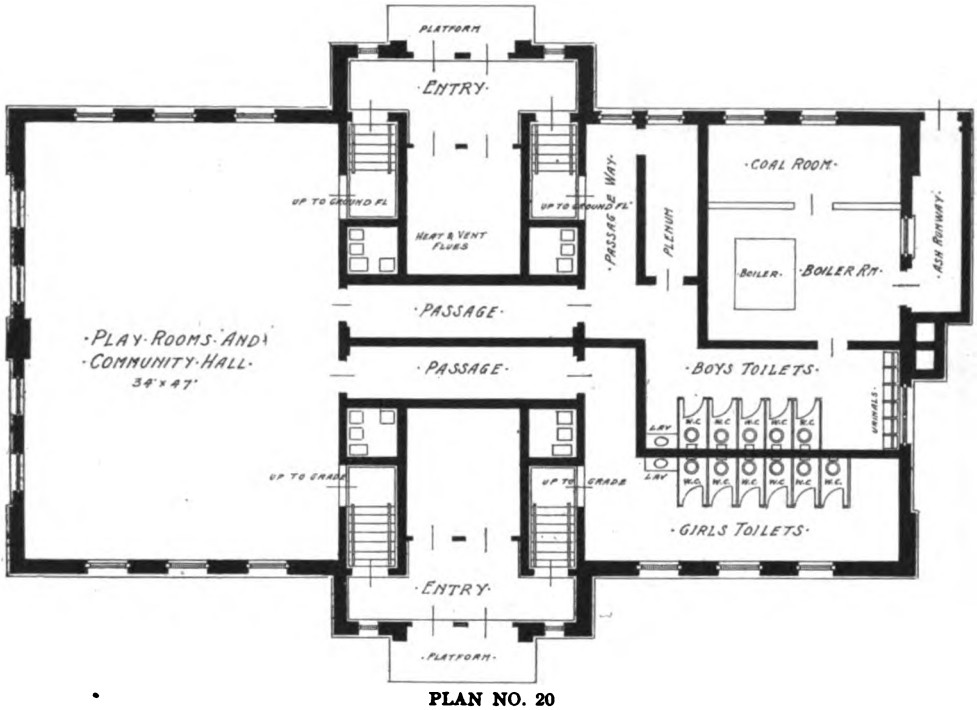
PLAN NO. 19
BASEMENT PLAN



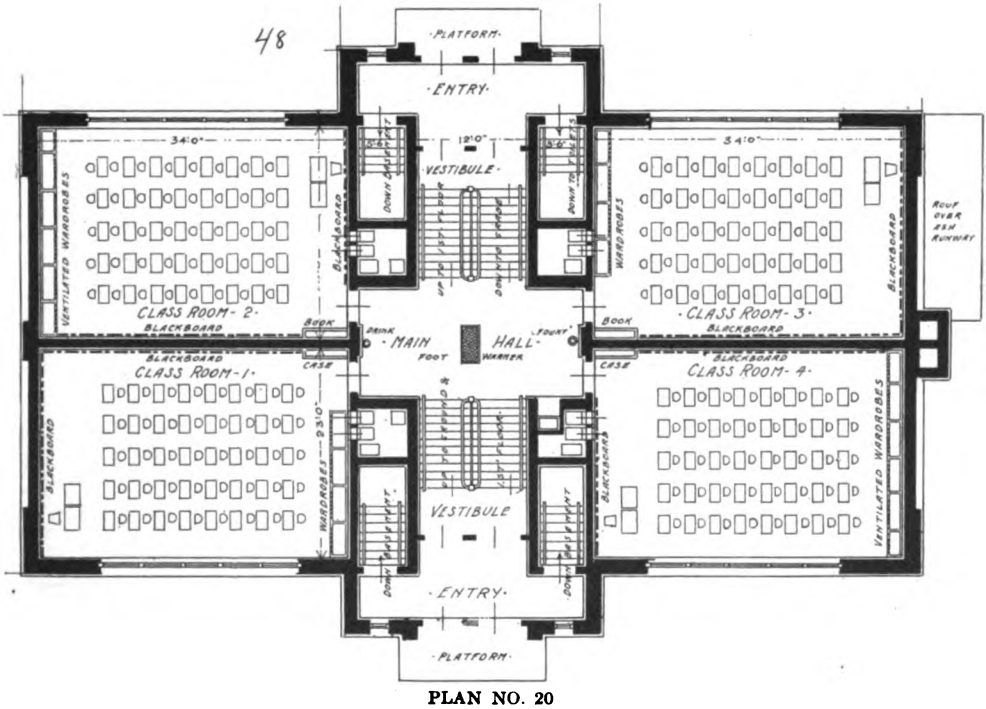
PLAN NO. 19
FIRST-FLOOR PLAN

rest room, household-science room, manual-training, and gymnasium and social rooms, boiler room, fresh-air room, and coal storage.

Digitized by Google

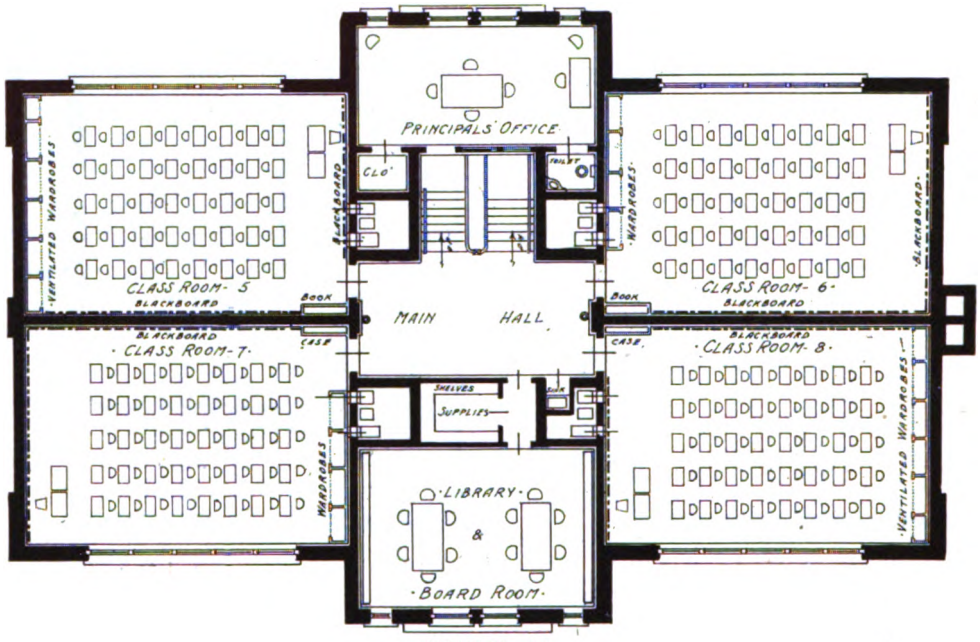


PLAN NO. 20
BASEMENT PLAN OF EIGHT-ROOM SCHOOLHOUSE



PLAN NO. 20
GROUND-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

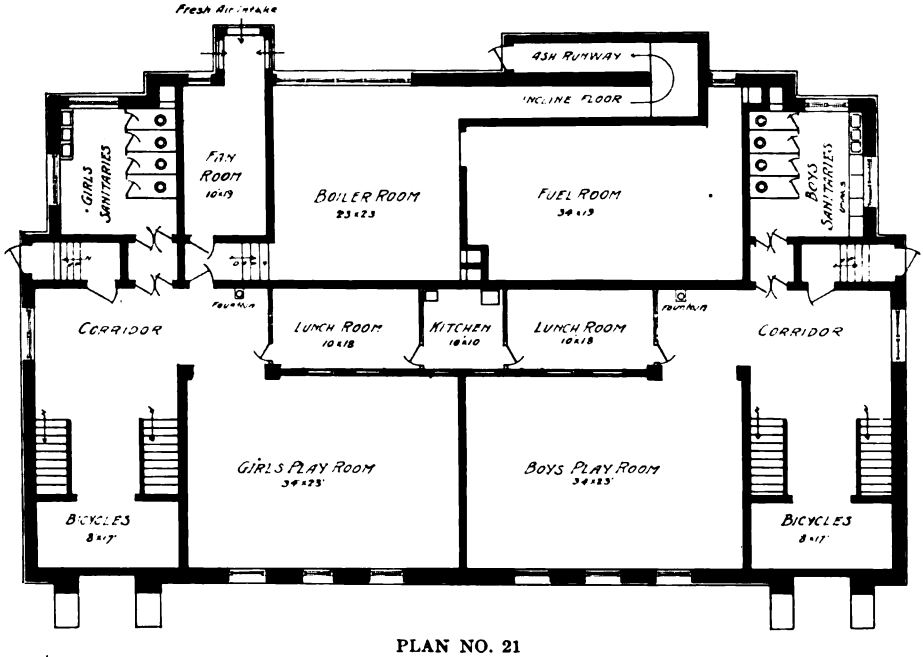
Digitized by Google



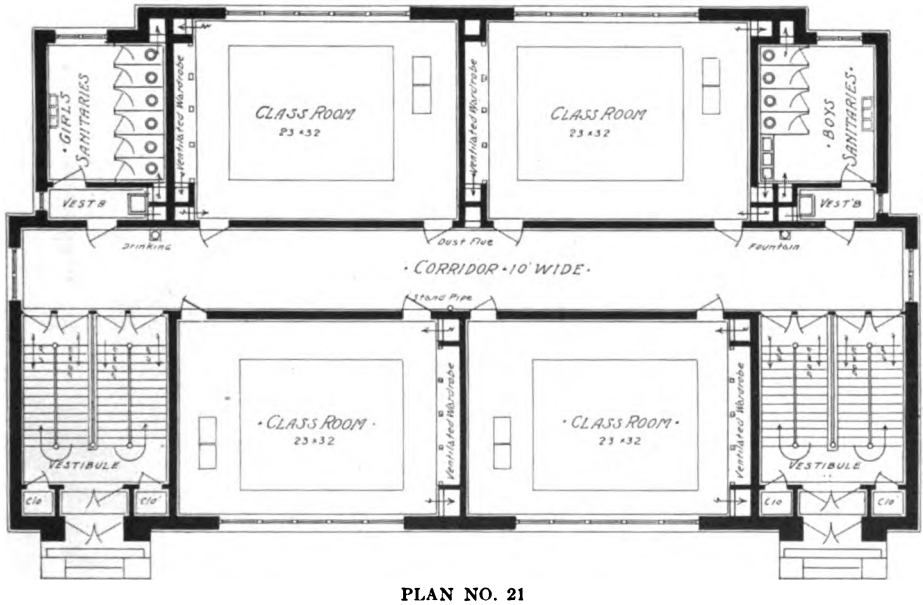
PLAN No. 20
FIRST-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

PLAN NO. 20
FRONT ELEVATION OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

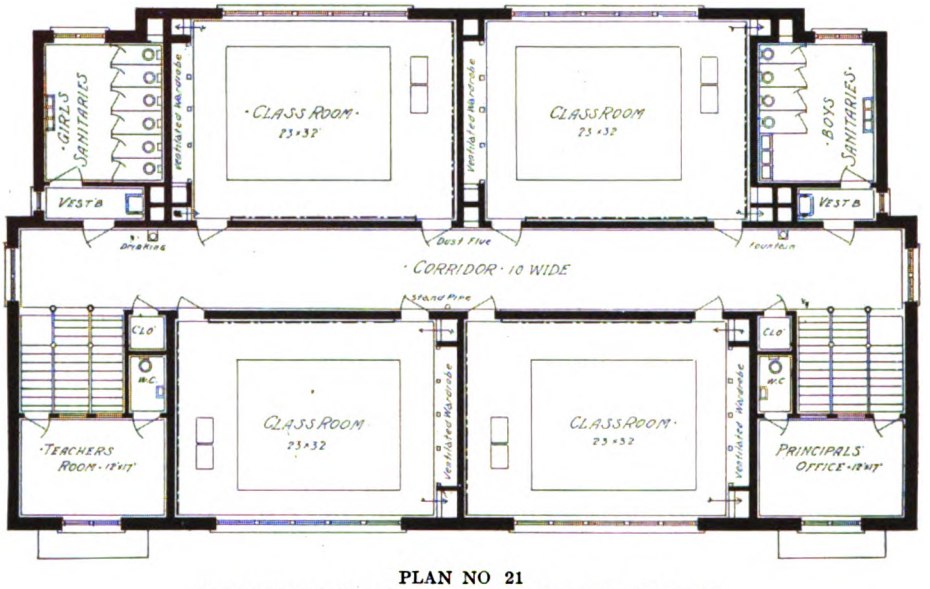


PLAN NO. 21
BASEMENT PLAN OF EIGHT-ROOM SCHOOLHOUSE

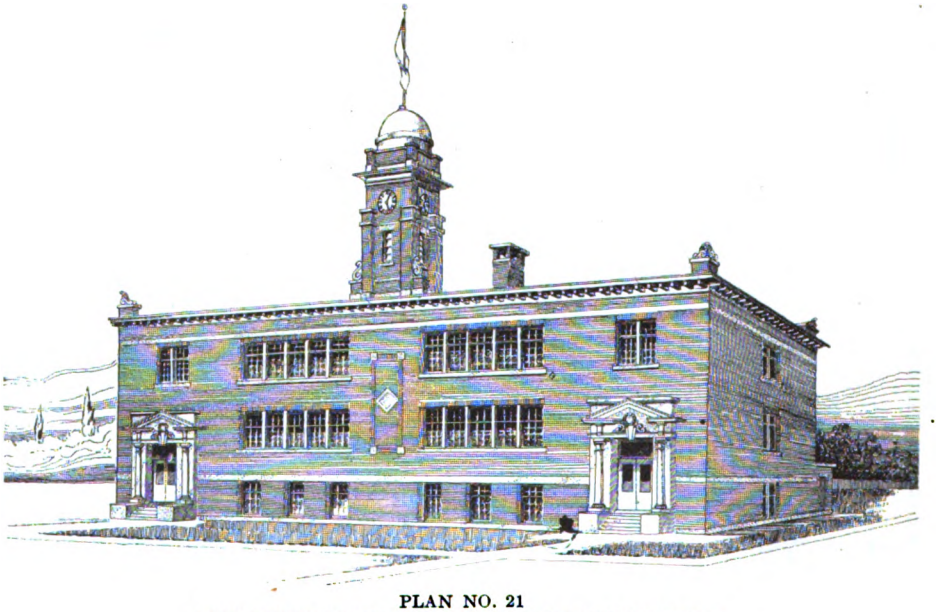


PLAN NO. 21
GROUND-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

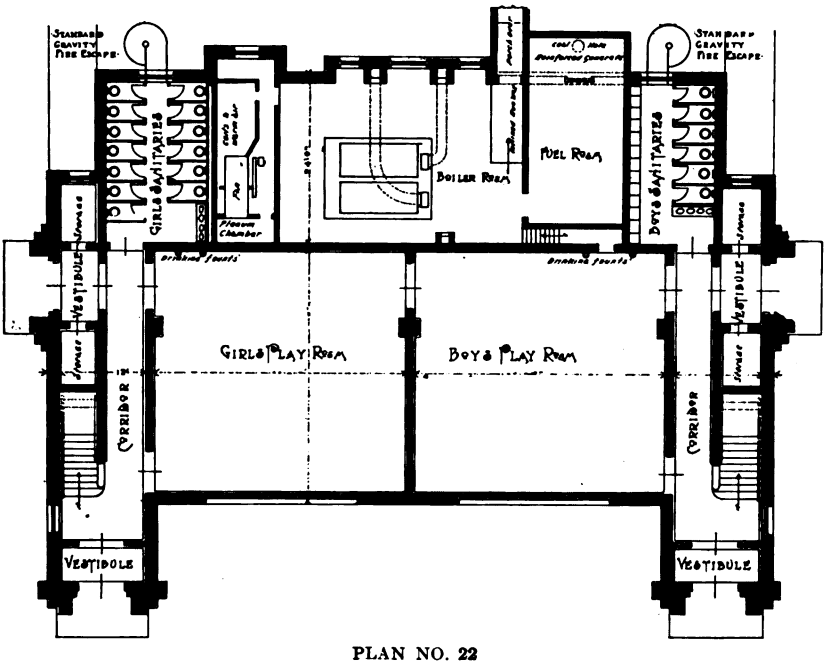


PLAN NO 21
FIRST-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

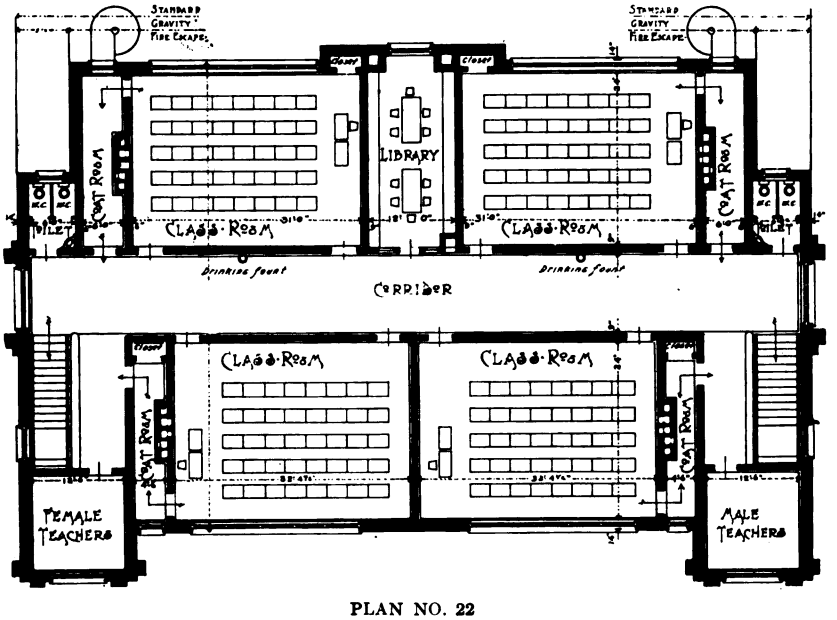


PLAN NO. 21
PERSPECTIVE VIEW OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

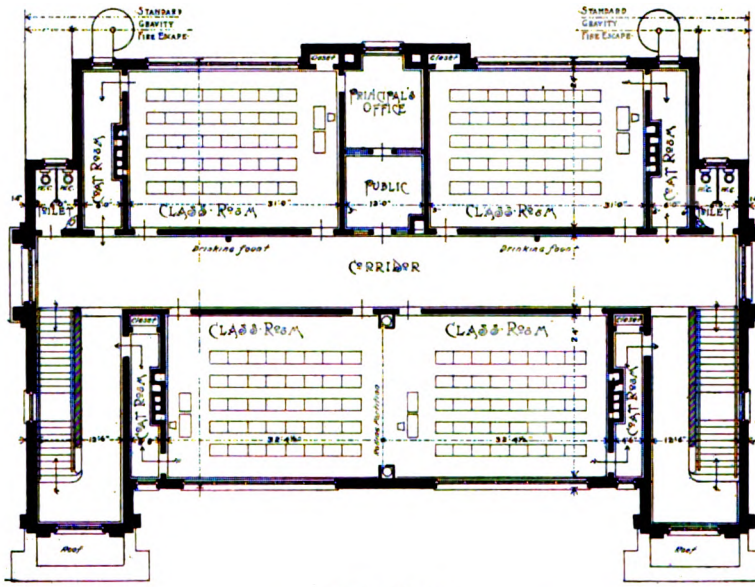


PLAN NO. 22
BASEMENT PLAN OF EIGHT-ROOM SCHOOLHOUSE



PLAN NO. 22
GROUND-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

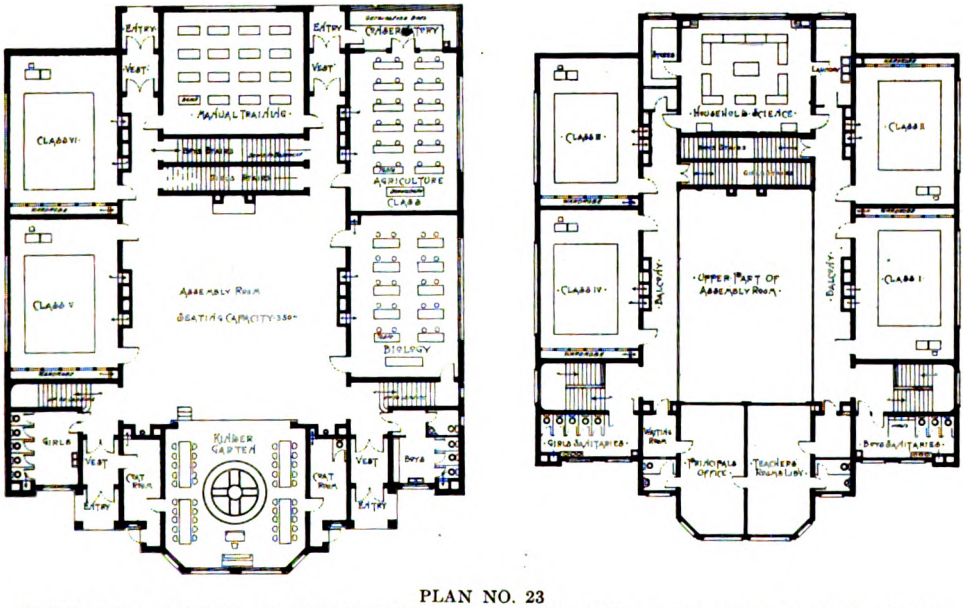


PLAN NO. 22
FIRST-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

PLAN NO. 22
FRONT ELEVATION OF EIGHT-ROOM SCHOOLHOUSE

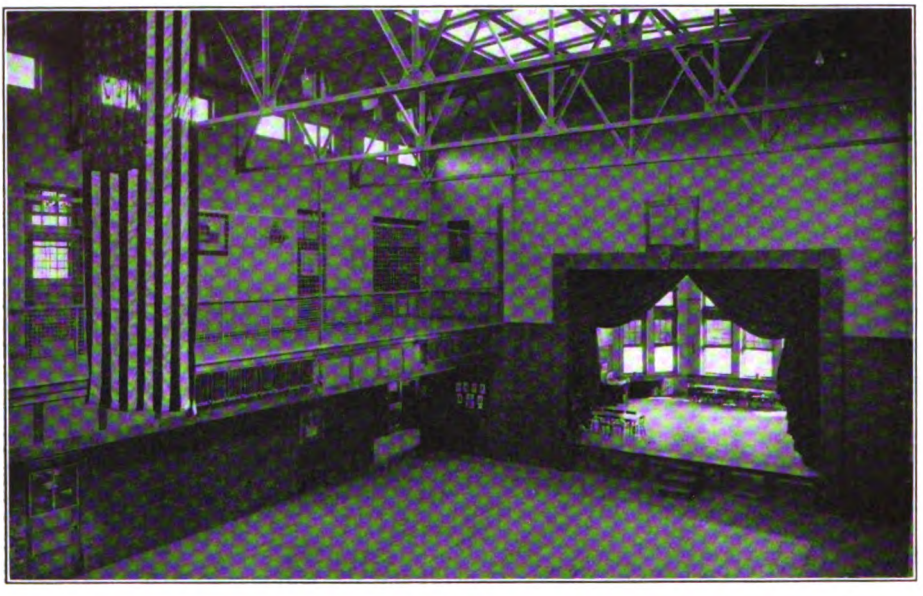
Digitized by Google

PLAN NO. 23
EXTERIOR VIEW OF "CONSOLIDATED" SCHOOLHOUSE

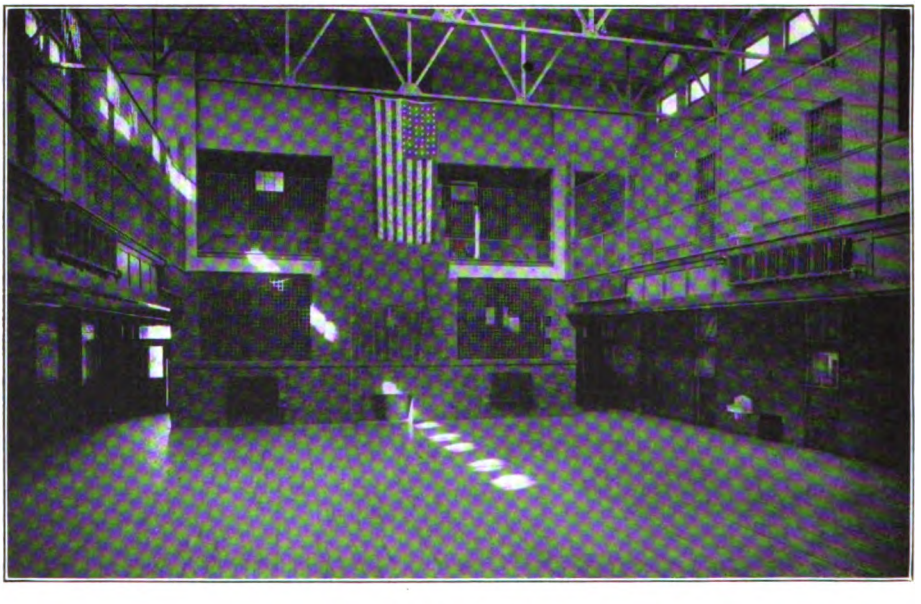


PLAN NO. 23
GROUND-FLOOR PLAN OF "CONSOLIDATED" SIX-CLASS-ROOM SCHOOLHOUSE, CONTAINING MANUAL TRAINING, AGRICULTURAL, BIOLOGY, KINDERGARTEN, HOUSEHOLD SCIENCE AND ASSEMBLY ROOMS

Digitized by Google

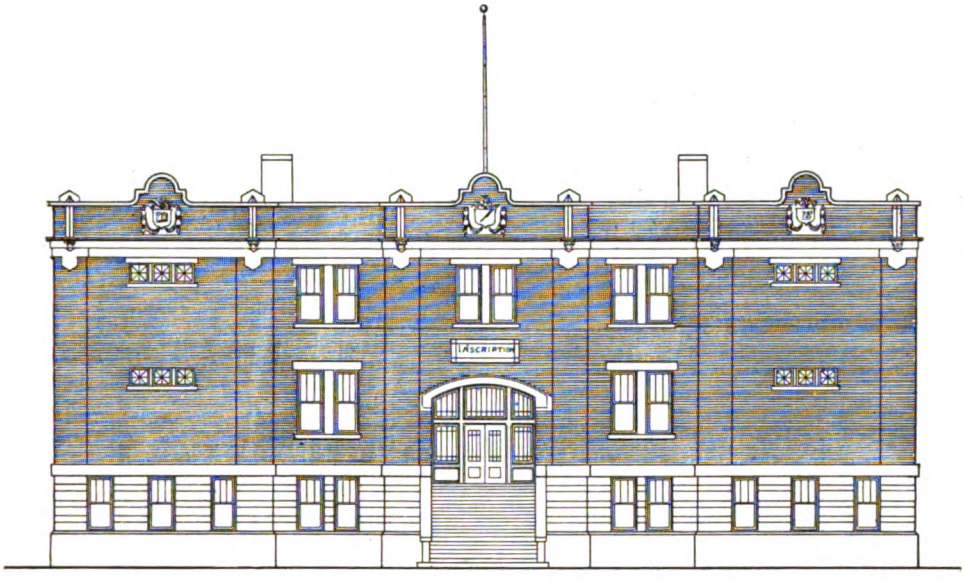


PLAN NO. 23
INTERIOR VIEW, THROUGH AUDITORIUM, TOWARDS KINDERGARTEN OF "CONSOLIDATED" SCHOOLHOUSE

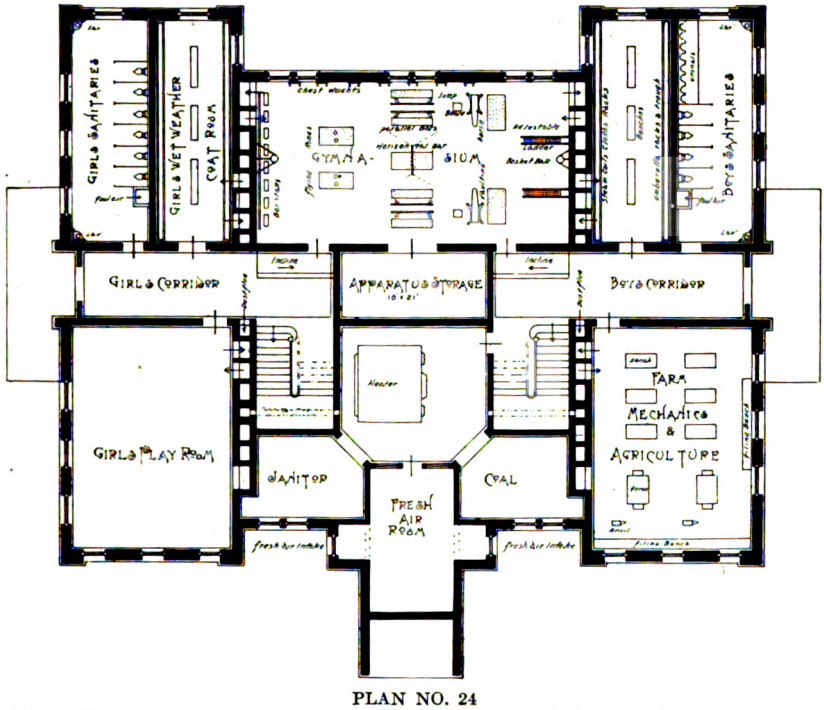


PLAN NO. 23
INTERIOR VIEW, THROUGH AUDITORIUM, TOWARDS FIREPLACE OF "CONSOLIDATED" SCHOOLHOUSE

Digitized by Google

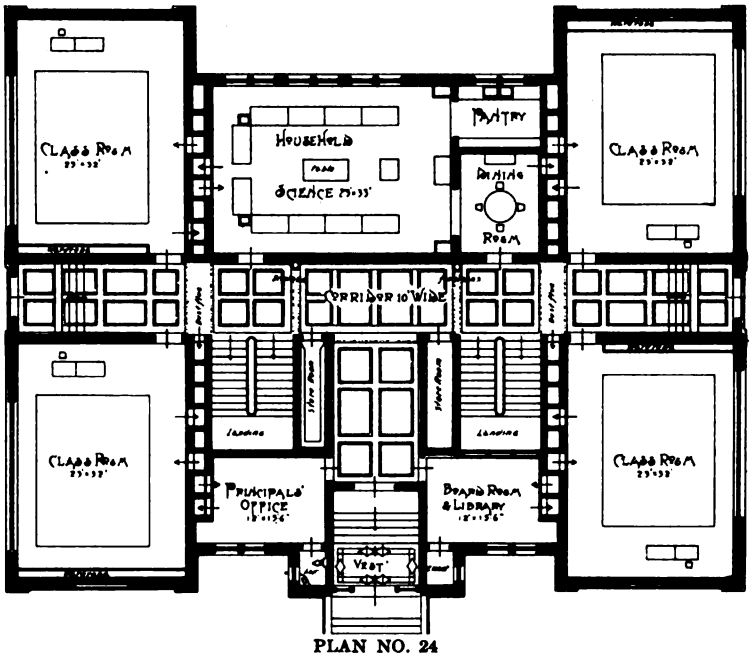


PLAN NO. 24
FRONT ELEVATION OF SIX-OR-EIGHT-CLASS-ROOM HIGH SCHOOL, CONTAINING FARM MECHANICS, AGRICULTURE, GYMNASIUM, HOUSEHOLD SCIENCE ROOMS AND ASSEMBLY HALL



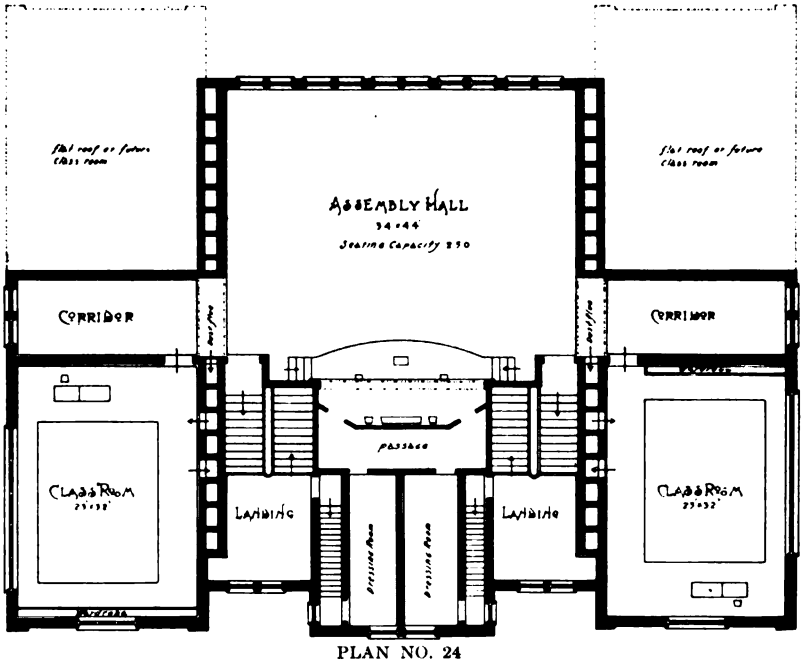
PLAN NO. 24
BASEMENT PLAN OF SIX-OR-EIGHT-CLASS-ROOM HIGH SCHOOL, CONTAINING FARM MECHANICS, AGRICULTURE, GYMNASIUM, HOUSEHOLD SCIENCE ROOMS AND ASSEMBLY HALL

Digitized by Google



PLAN NO. 24

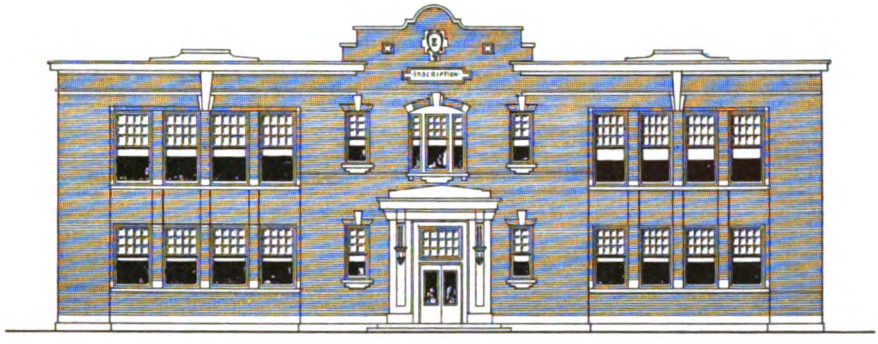
GROUND-FLOOR PLAN OF SIX-OR-EIGHT-CLASS-ROOM HIGH SCHOOL, CONTAINING FARM MECHANICS, AGRICULTURE, GYMNASIUM, HOUSEHOLD SCIENCE ROOMS AND ASSEMBLY HALL



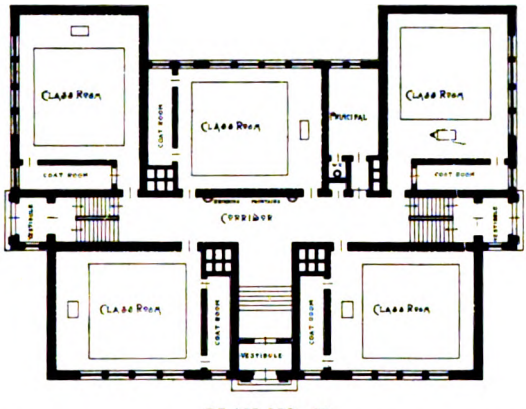
PLAN NO. 24

FIRST-FLOOR PLAN OF SIX-OR-EIGHT-CLASS-ROOM HIGH SCHOOL, CONTAINING FARM MECHANICS, AGRICULTURE, GYMNASIUM, HOUSEHOLD SCIENCE ROOMS AND ASSEMBLY HALL

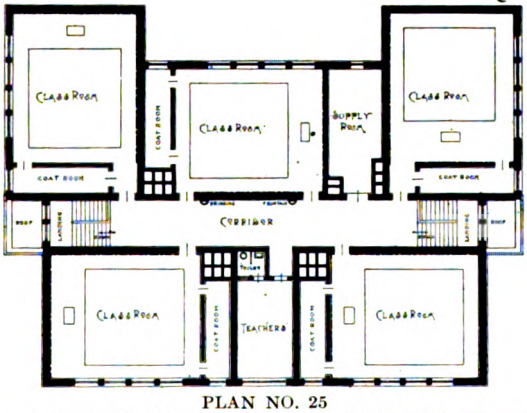
Digitized by Google



PLAN NO. 25
FRONT ELEVATION OF TEN-ROOM GRADE SCHOOL

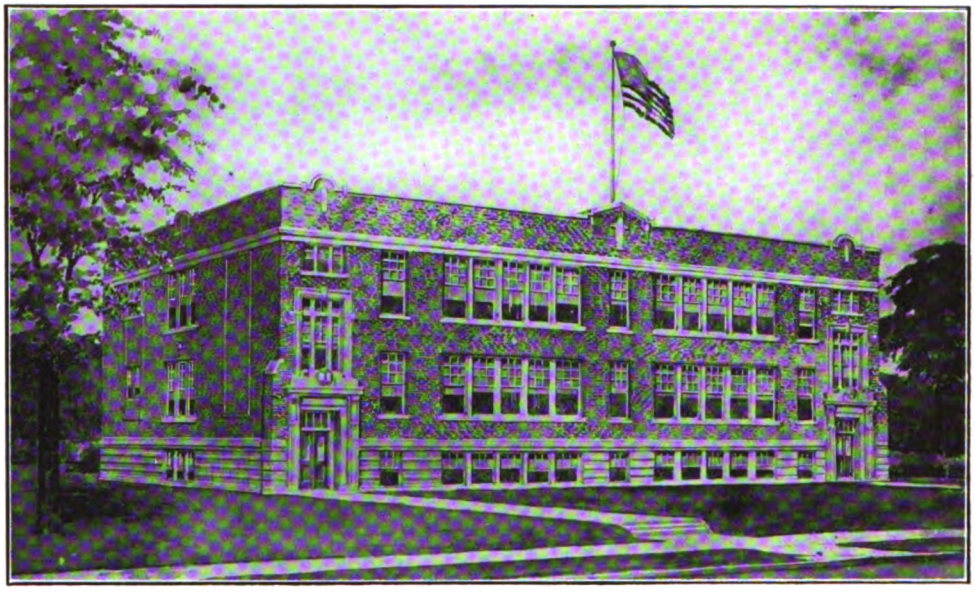


PLAN NO. 25
GROUND-FLOOR PLAN OF TEN-ROOM GRADE SCHOOL

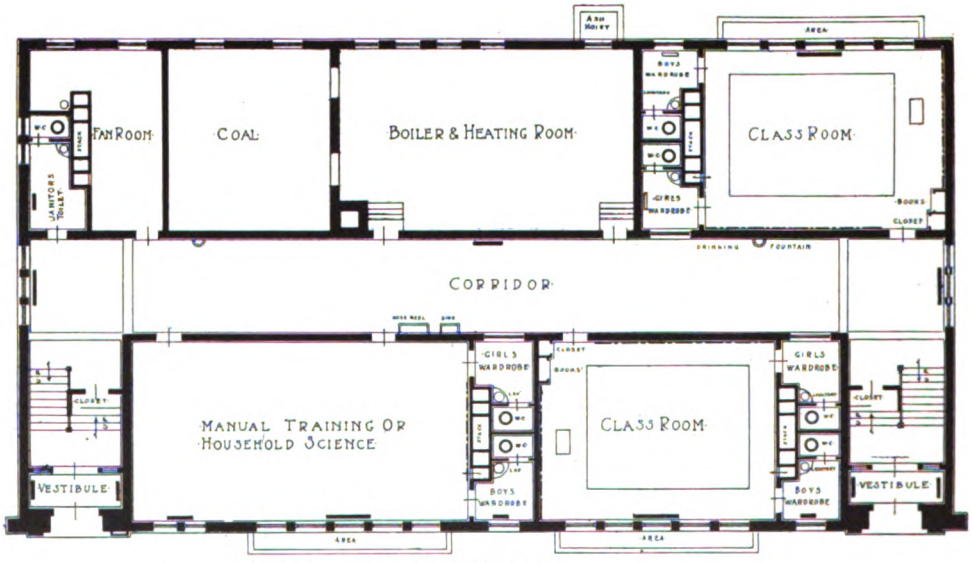


PLAN NO. 25
FIRST-FLOOR PLAN OF TEN-ROOM GRADE SCHOOL

Digitized by Google

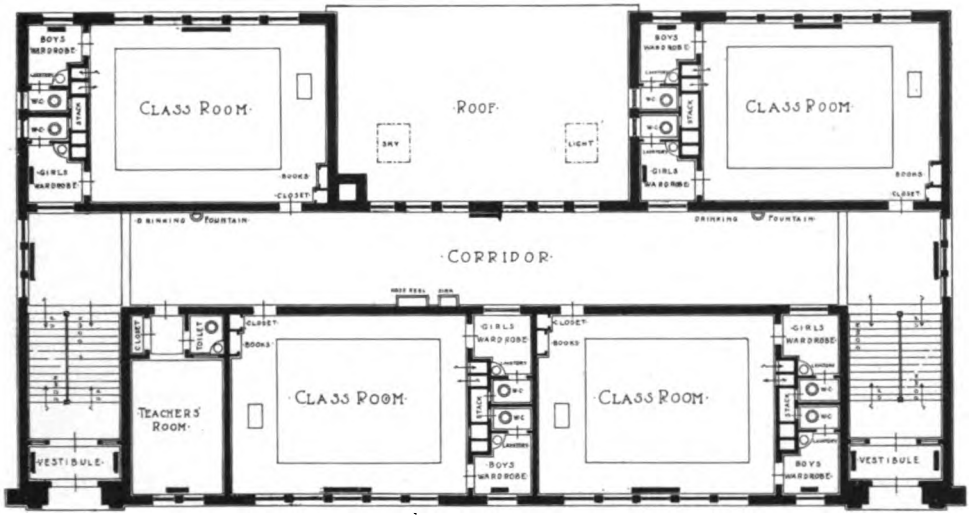


PLAN NO. 26
PERSPECTIVE VIEW OF EIGHT-ROOM SCHOOLHOUSE

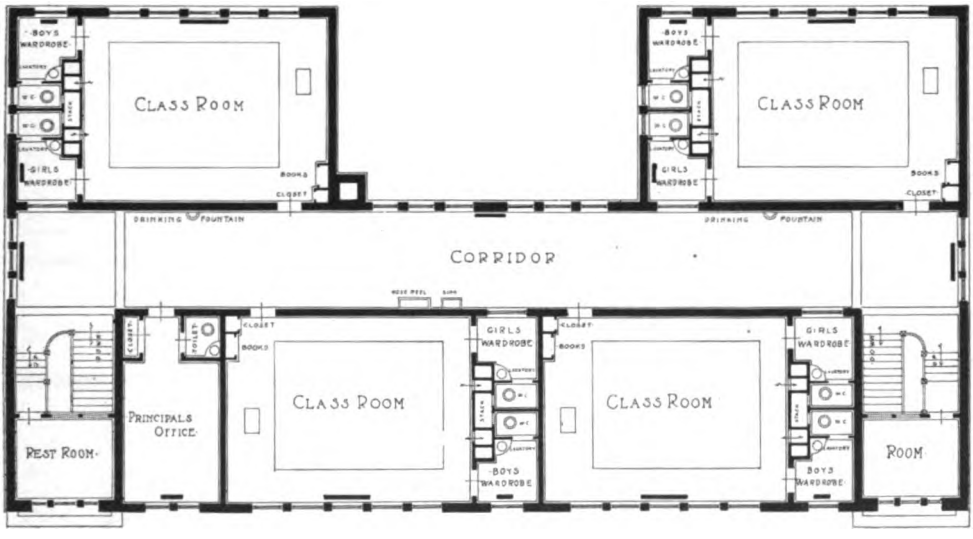


PLAN NO. 26
BASEMENT PLAN OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

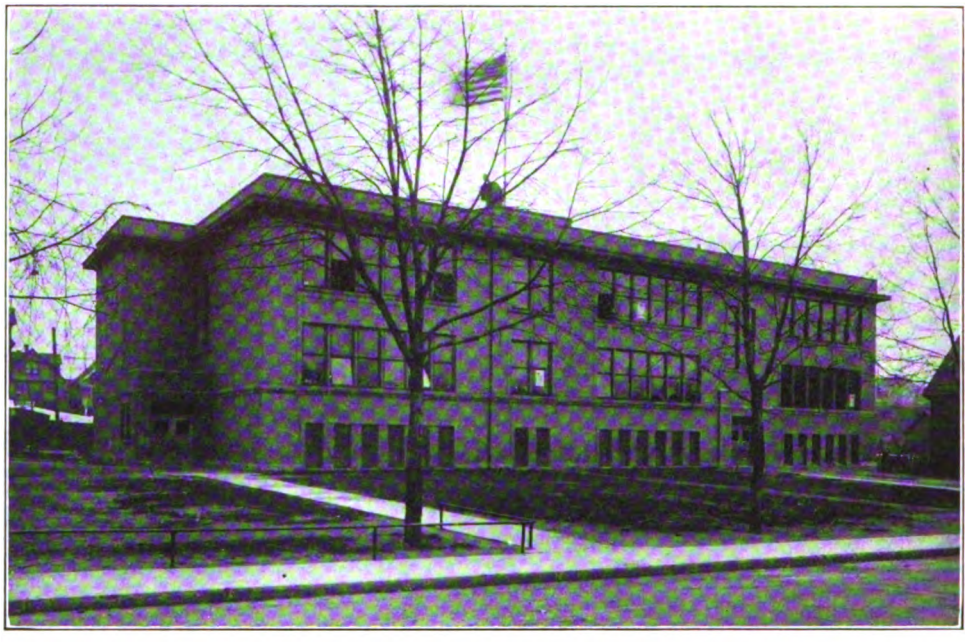


PLAN NO. 26
GROUND-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

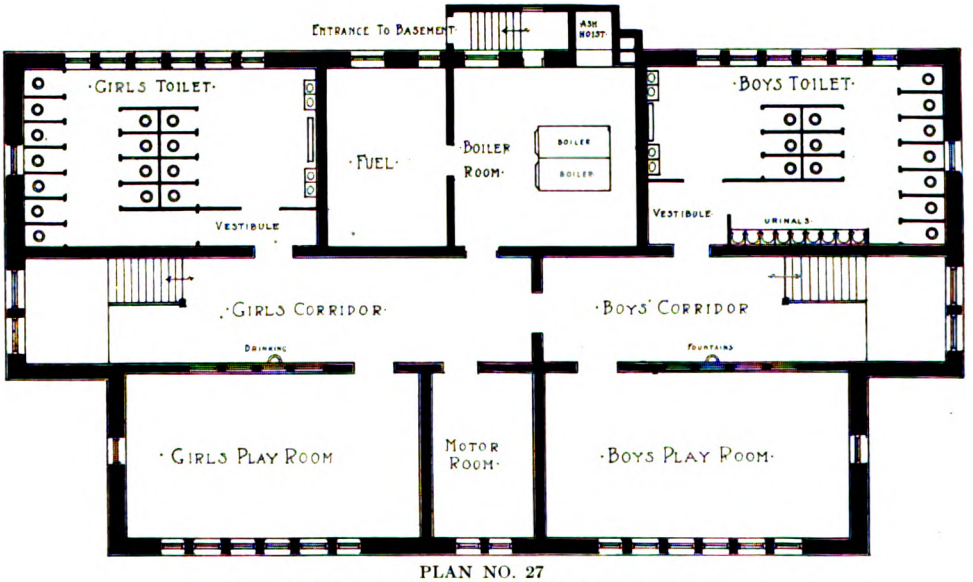


PLAN NO. 26
FIRST-FLOOR PLAN OF EIGHT-ROOM SCHOOLHOUSE

Digitized by Google

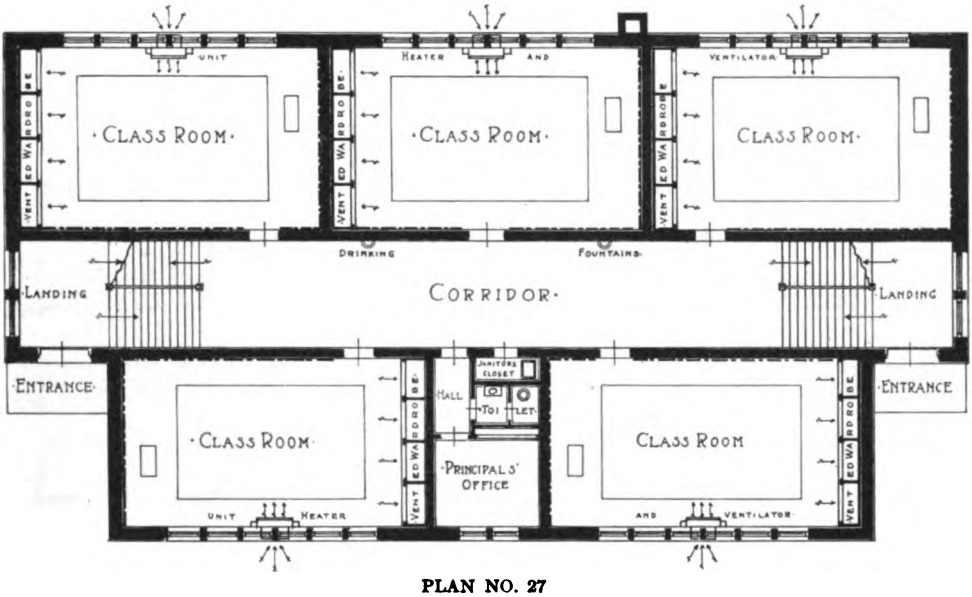


PLAN NO. 27
FRONT ELEVATION OF TEN-ROOM SCHOOLHOUSE

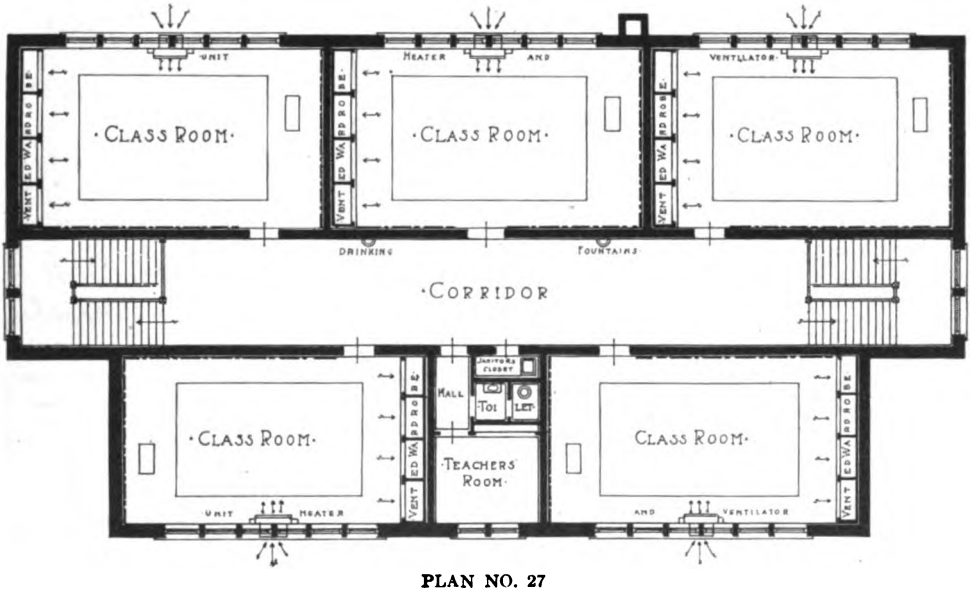


PLAN NO. 27
BASEMENT PLAN OF TEN-ROOM SCHOOLHOUSE

Digitized by Google

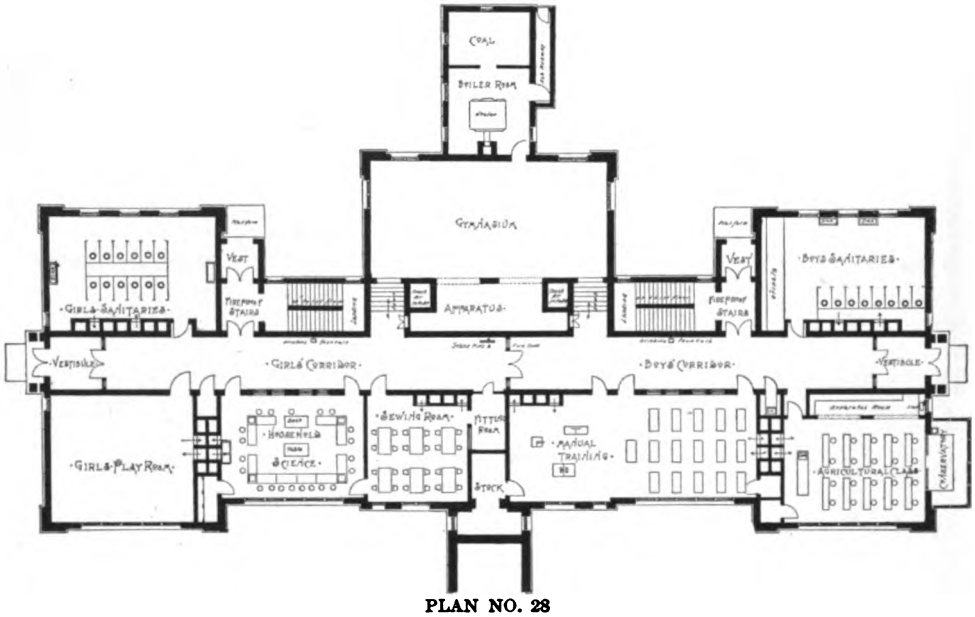


PLAN NO. 27
GROUND-FLOOR PLAN OF TEN-ROOM SCHOOLHOUSE

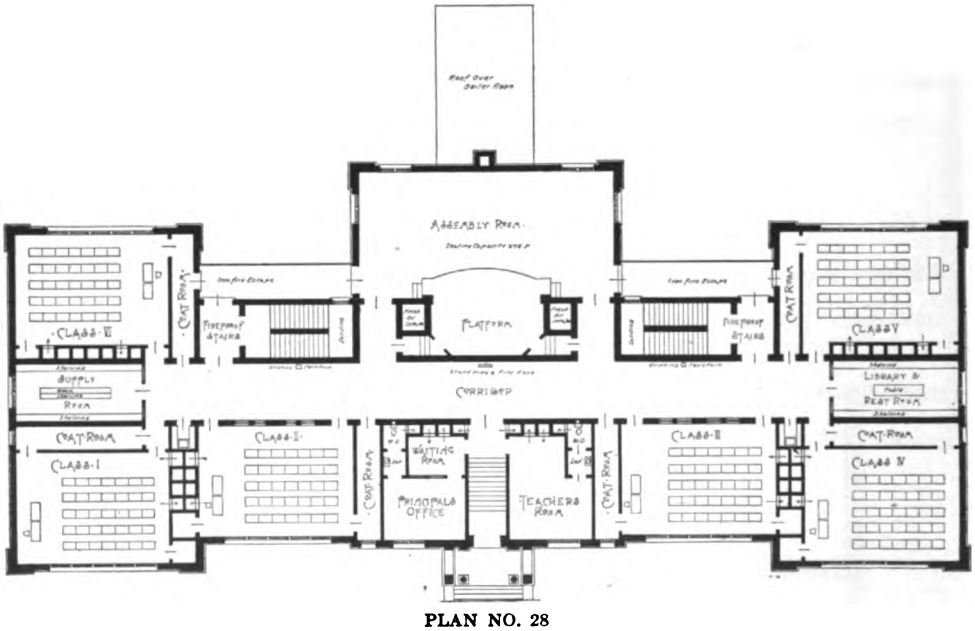


PLAN NO. 27
FIRST-FLOOR PLAN OF TEN-ROOM SCHOOLHOUSE

Digitized by Google

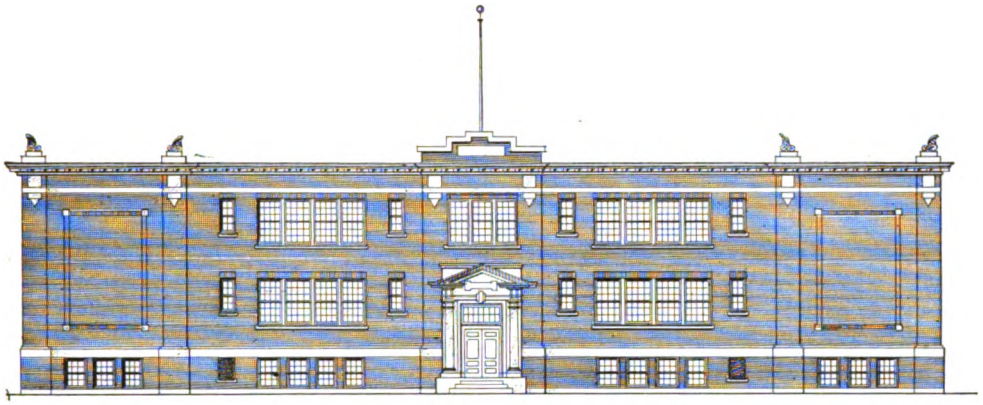


PLAN NO. 28
BASEMENT PLAN OF "CONSOLIDATED" SCHOOLHOUSE, CONTAINING SIX CLASS ROOMS, ASSEMBLY HALL, HOUSEHOLD SCIENCE, SEWING, MANUAL-TRAINING, AGRICULTURE ROOMS AND GYMNASIUM

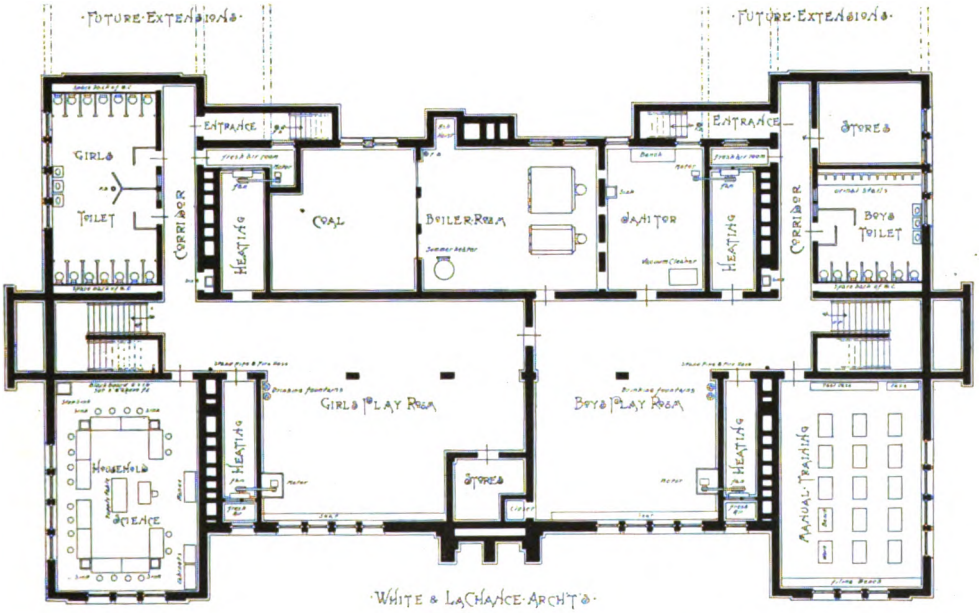


PLAN NO. 28
GROUND-FLOOR PLAN OF "CONSOLIDATED" SCHOOLHOUSE CONTAINING SIX CLASS ROOMS, ASSEMBLY HALL, HOUSEHOLD SCIENCE, SEWING, MANUAL-TRAINING, AGRICULTURE ROOMS AND GYMNASIUM

Digitized by Google

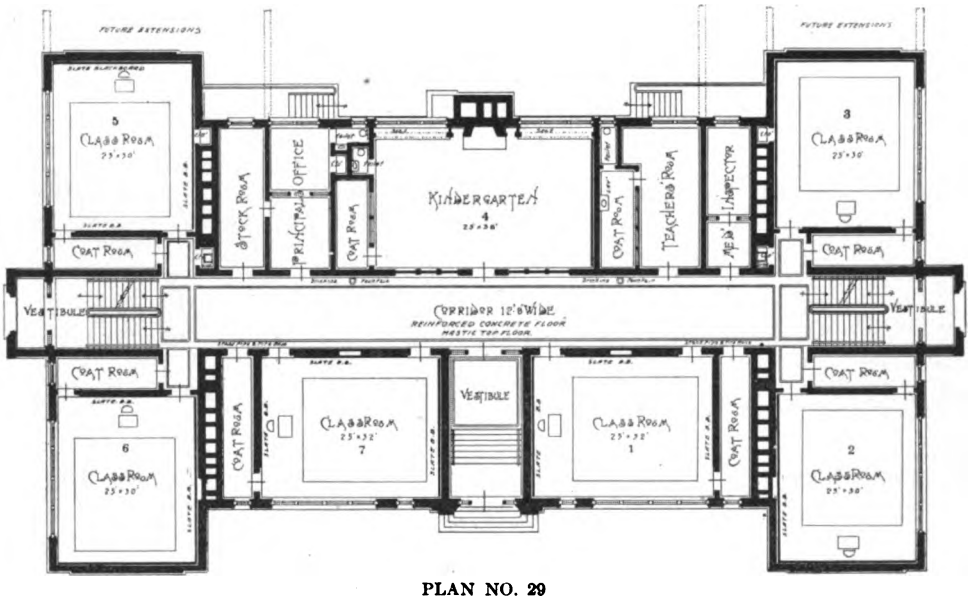


PLAN NO. 29
FRONT ELEVATION OF ELEVEN-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL, HOUSEHOLD SCIENCE AND MANUAL-TRAINING ROOMS

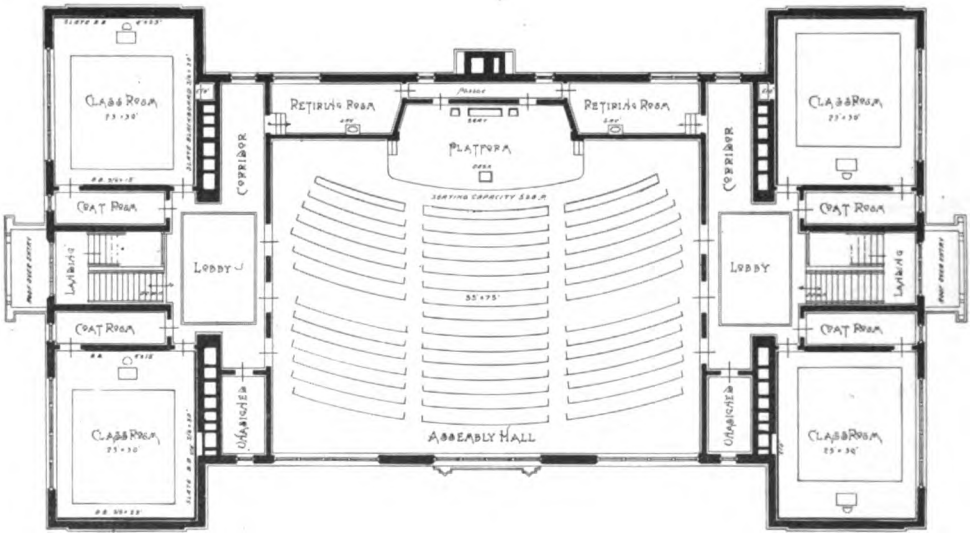


PLAN NO. 29
BASEMENT PLAN OF ELEVEN-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL, HOUSEHOLD SCIENCE AND MANUAL-TRAINING ROOMS

Digitized by Google

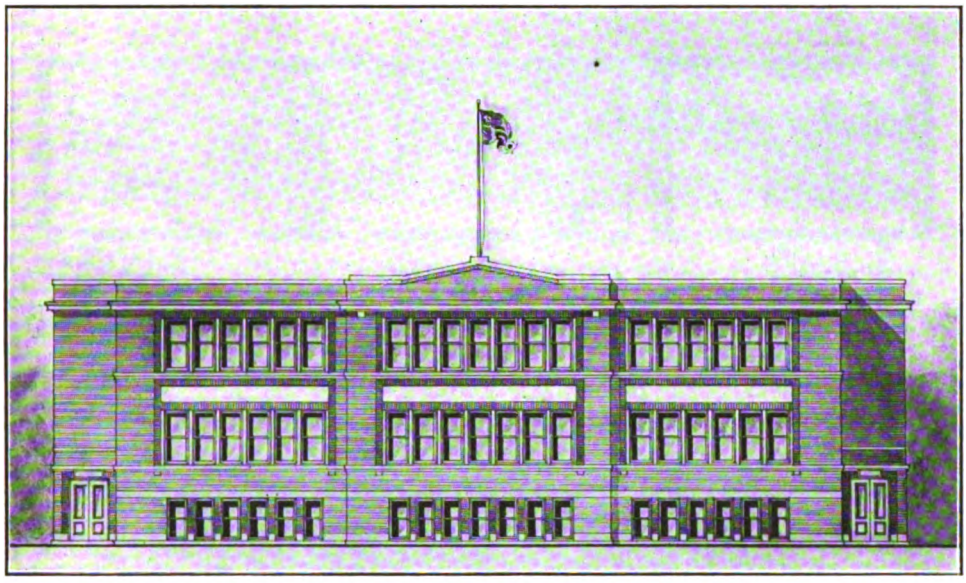


PLAN NO. 29
GROUND-FLOOR PLAN OF ELEVEN-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL, HOUSEHOLD SCIENCE AND MANUAL-TRAINING ROOMS

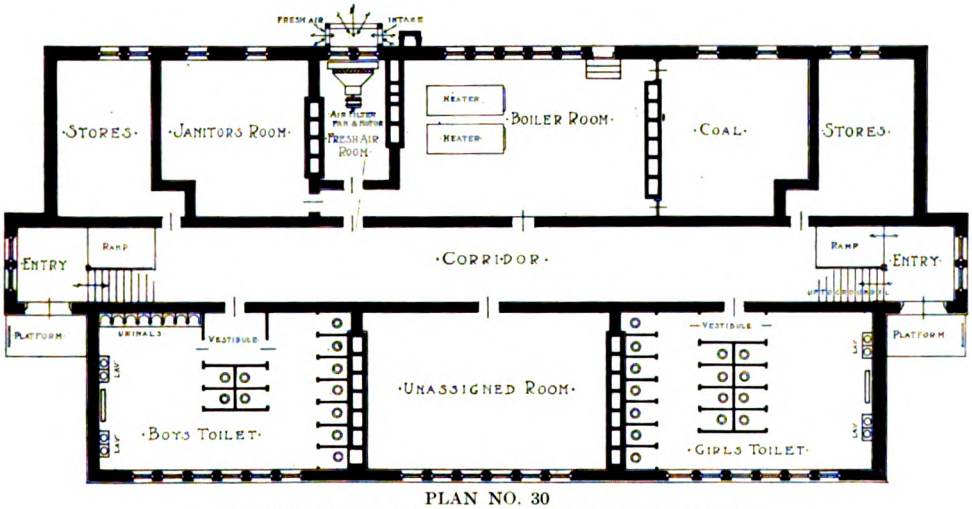


PLAN NO. 29
FIRST-FLOOR PLAN OF ELEVEN-ROOM SCHOOLHOUSE WITH ASSEMBLY HALL, HOUSEHOLD SCIENCE AND MANUAL-TRAINING ROOMS

Digitized by Google

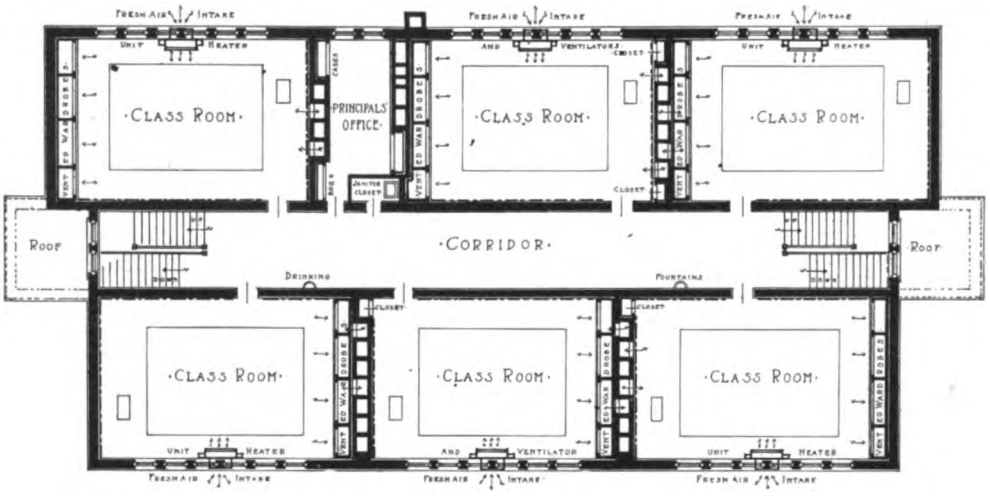


PLAN NO. 30
FRONT ELEVATION OF TWELVE-ROOM SCHOOLHOUSE

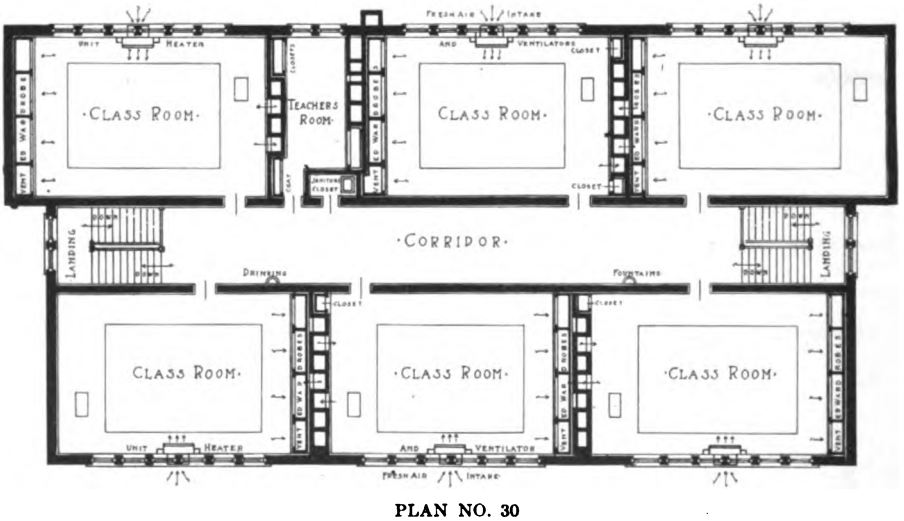


PLAN NO. 30
BASEMENT PLAN OF TWELVE-ROOM SCHOOLHOUSE

Digitized by Google

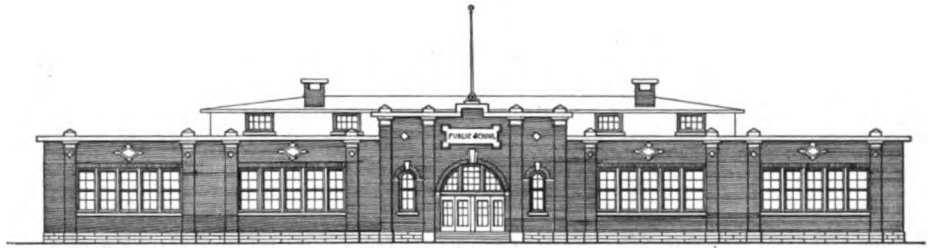


PLAN NO. 30
GROUND-FLOOR PLAN OF TWELVE-ROOM SCHOOLHOUSE

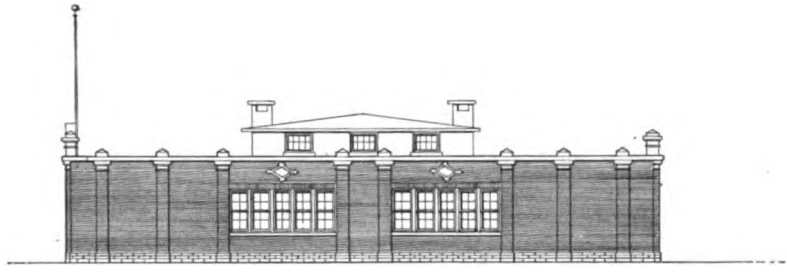


PLAN NO. 30
FIRST-FLOOR PLAN OF TWELVE-ROOM SCHOOLHOUSE

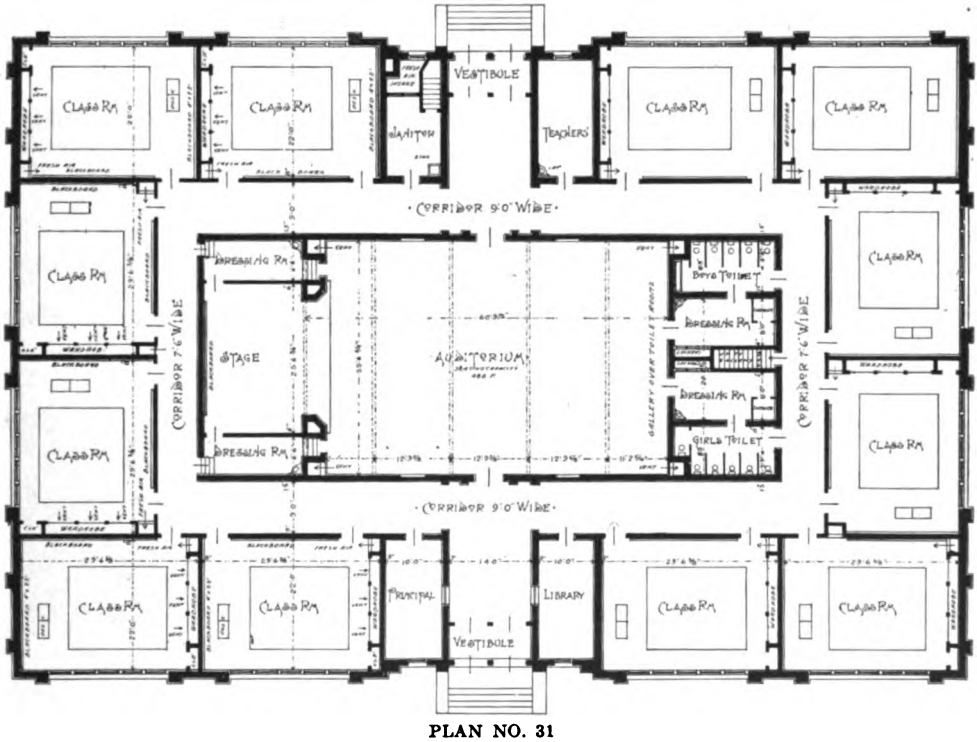
Digitized by Google



PLAN NO. 31
FRONT ELEVATION OF ONE-STORY, TWELVE-ROOM SCHOOLHOUSE WITH AUDITORIUM

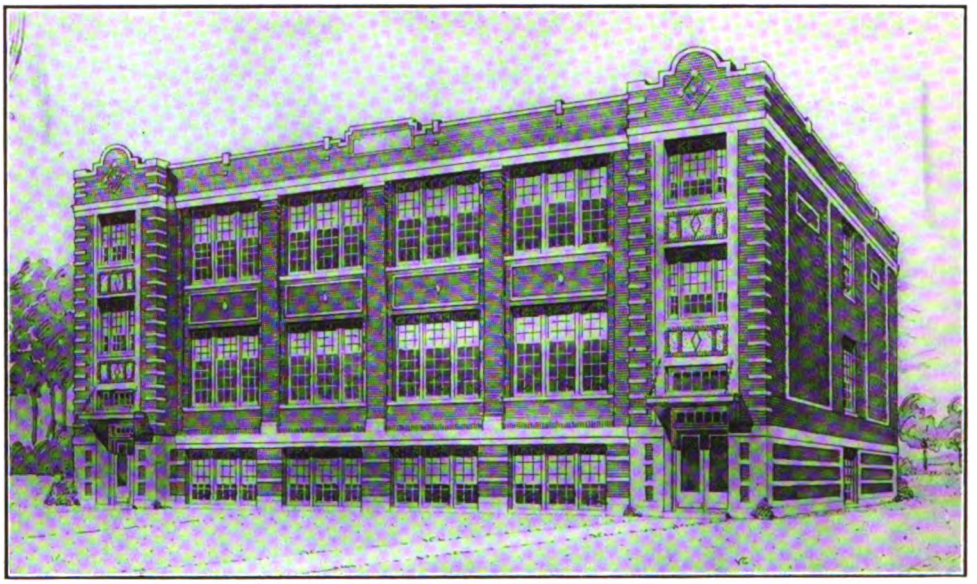


PLAN NO. 31
SIDE ELEVATION OF ONE-STORY, TWELVE-ROOM SCHOOLHOUSE WITH AUDITORIUM

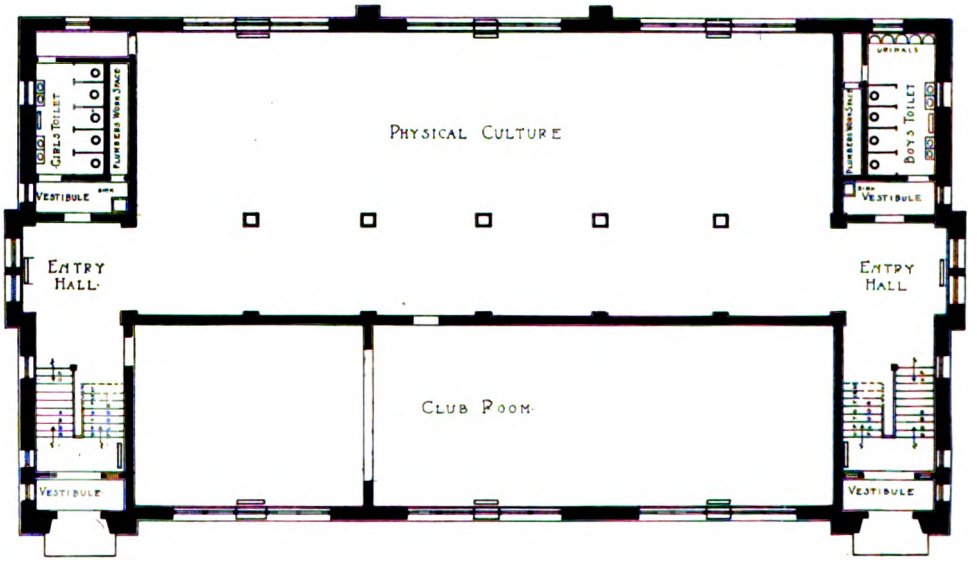


PLAN NO. 31
GROUND-FLOOR PLAN OF ONE-STORY, TWELVE-ROOM SCHOOLHOUSE WITH AUDITORIUM

Digitized by Google

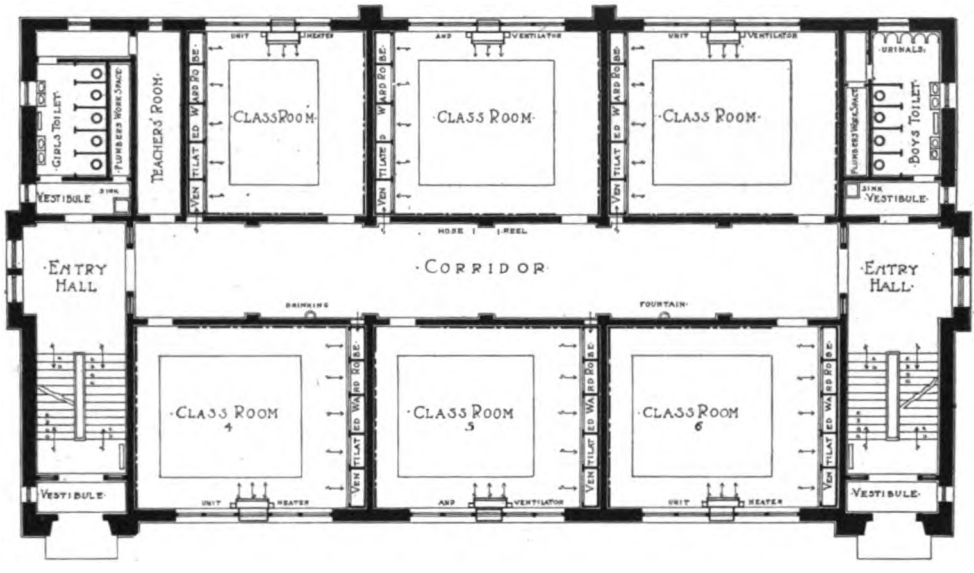


PLAN NO. 32
PERSPECTIVE VIEW OF TWELVE-ROOM SCHOOLHOUSE

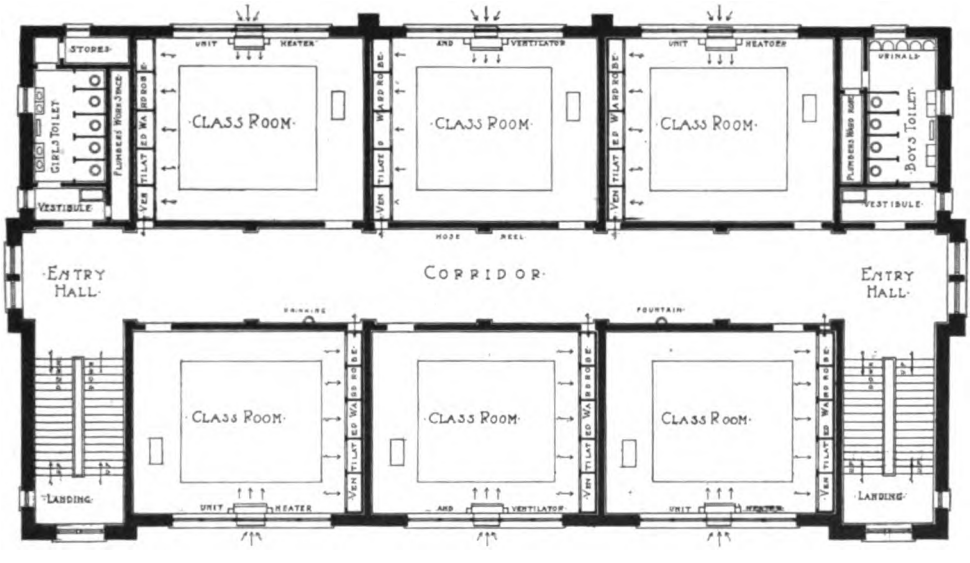


PLAN NO. 32
BASEMENT PLAN OF TWELVE-ROOM SCHOOLHOUSE

Digitized by Google

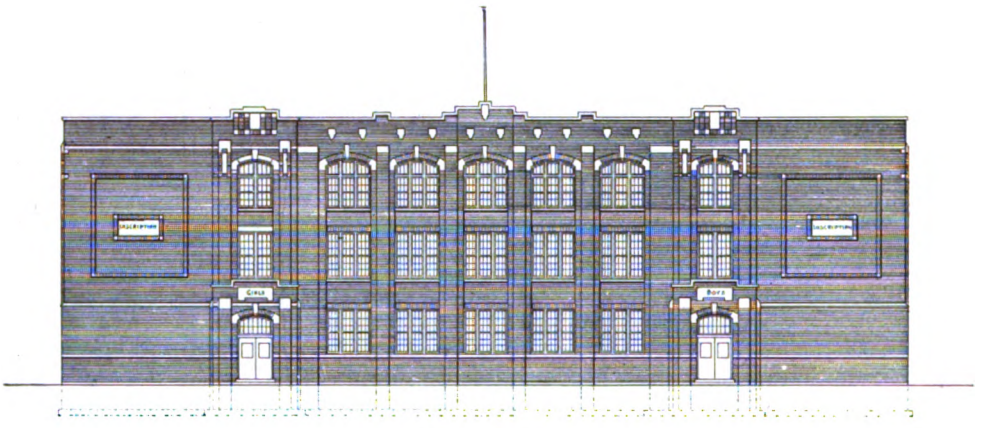


PLAN NO. 32
GROUND-FLOOR PLAN OF TWELVE-ROOM SCHOOLHOUSE



PLAN NO. 32
FIRST-FLOOR PLAN OF TWELVE-ROOM SCHOOLHOUSE

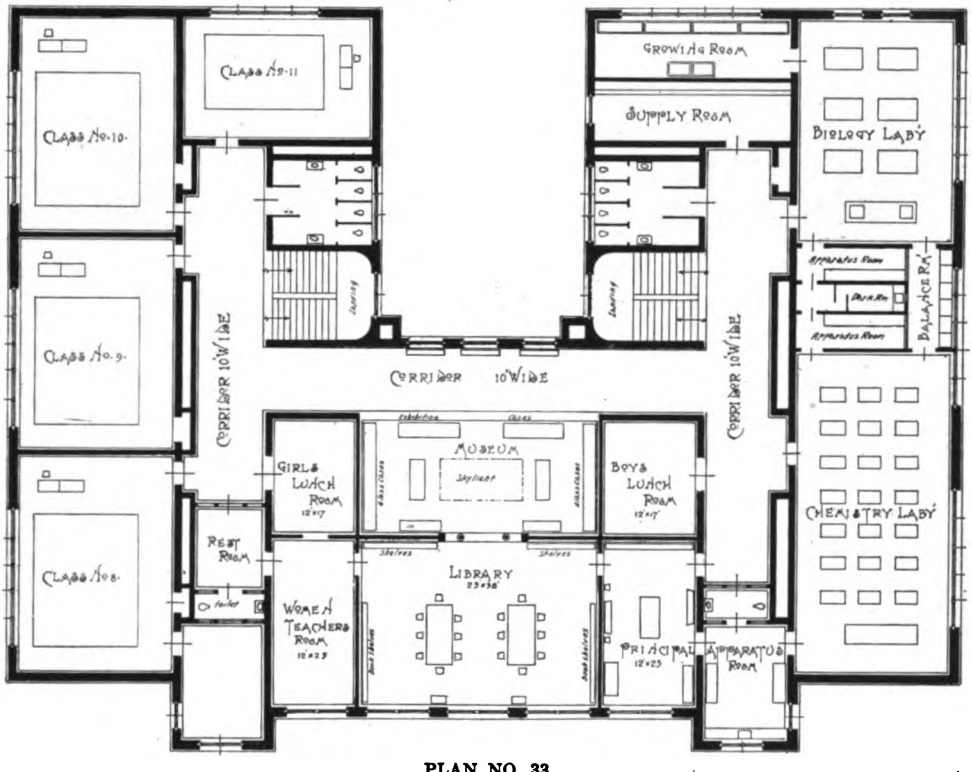
Digitized by Google



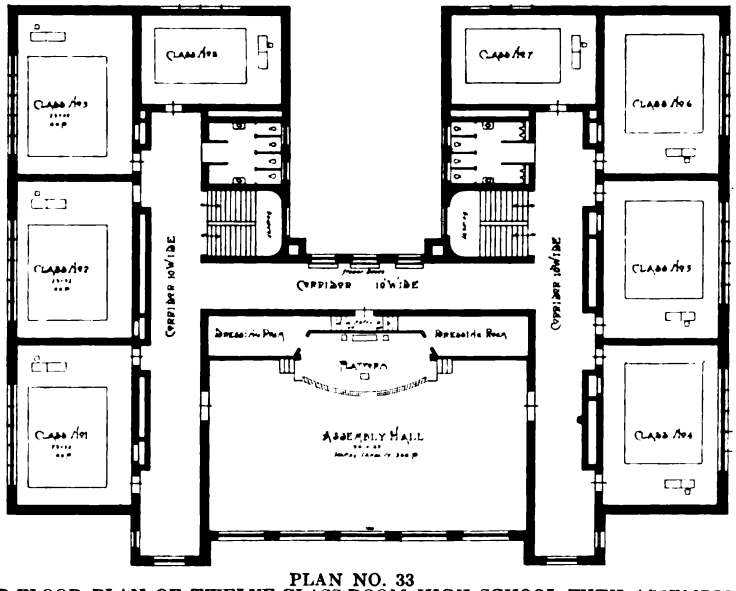
PLAN NO. 33
FRONT ELEVATION OF TWELVE-CLASS-ROOM HIGH SCHOOL WITH ASSEMBLY HALL, LIBRARY, MUSEUM, CHEMISTRY AND BIOLOGY LABORATORIES, HOUSEHOLD SCIENCE, MANUAL-TRAINING ROOMS AND GYMNASIUM

PLAN NO. 33
GROUND-FLOOR PLAN OF TWELVE-CLASS-ROOM HIGH SCHOOL WITH ASSEMBLY HALL, LIBRARY, MUSEUM, CHEMISTRY AND BIOLOGY LABORATORIES, HOUSEHOLD SCIENCE, MANUAL-TRAINING ROOMS AND GYMNASIUM

Digitized by Google

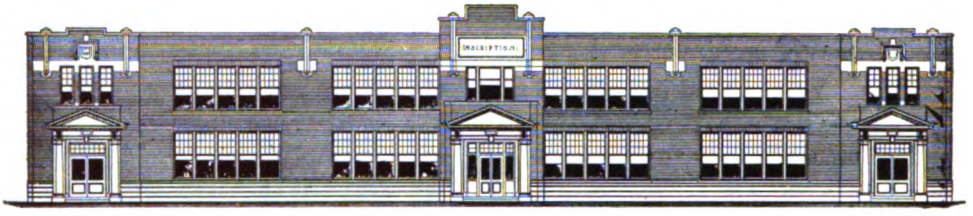


PLAN NO. 33
FIRST-FLOOR PLAN OF TWELVE-CLASS-ROOM HIGH SCHOOL WITH ASSEMBLY HALL, LIBRARY, MUSEUM, CHEMISTRY AND BIOLOGY LABORATORIES, HOUSEHOLD SCIENCE, MANUAL-TRAINING ROOMS AND GYMNASIUM

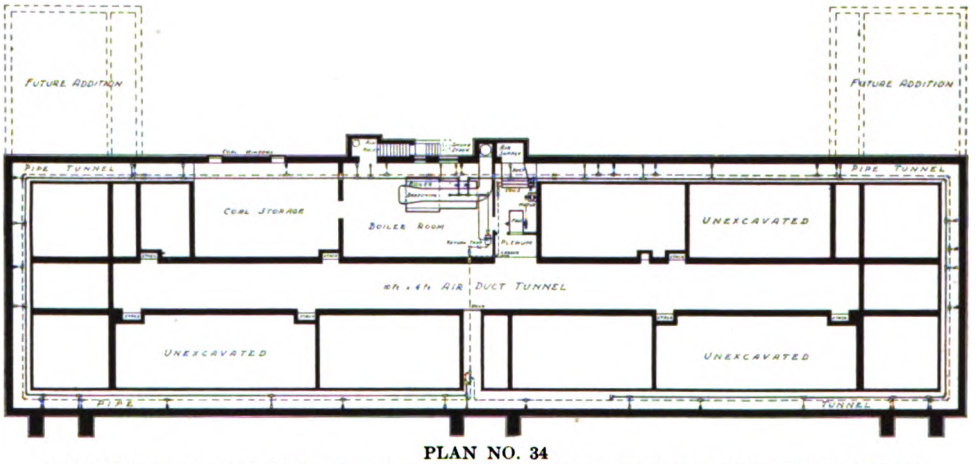


PLAN NO. 33
SECOND-FLOOR PLAN OF TWELVE-CLASS-ROOM HIGH SCHOOL WITH ASSEMBLY HALL, LIBRARY, MUSEUM, CHEMISTRY AND BIOLOGY LABORATORIES, HOUSEHOLD SCIENCE, MANUAL-TRAINING ROOMS AND GYMNASIUM

Digitized by Google



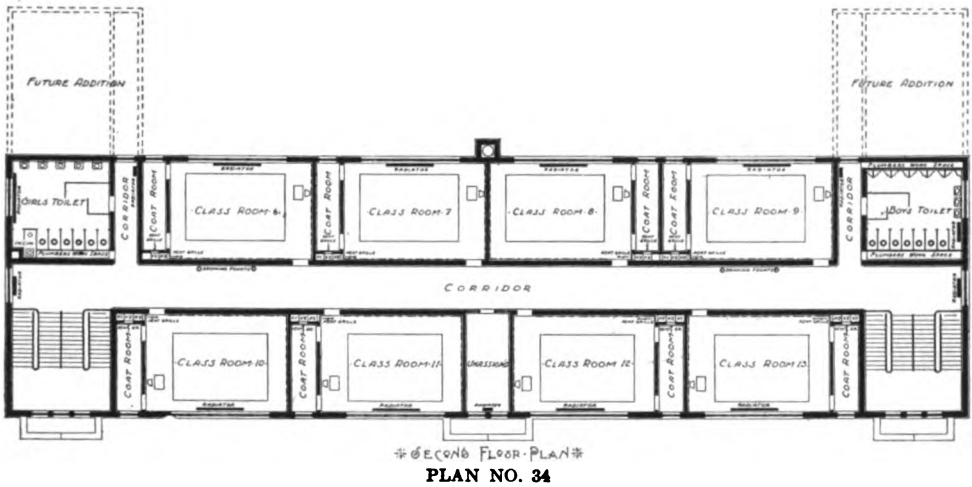
PLAN NO. 34
FRONT ELEVATION OF FOURTEEN-CLASS-ROOM SCHOOLHOUSE



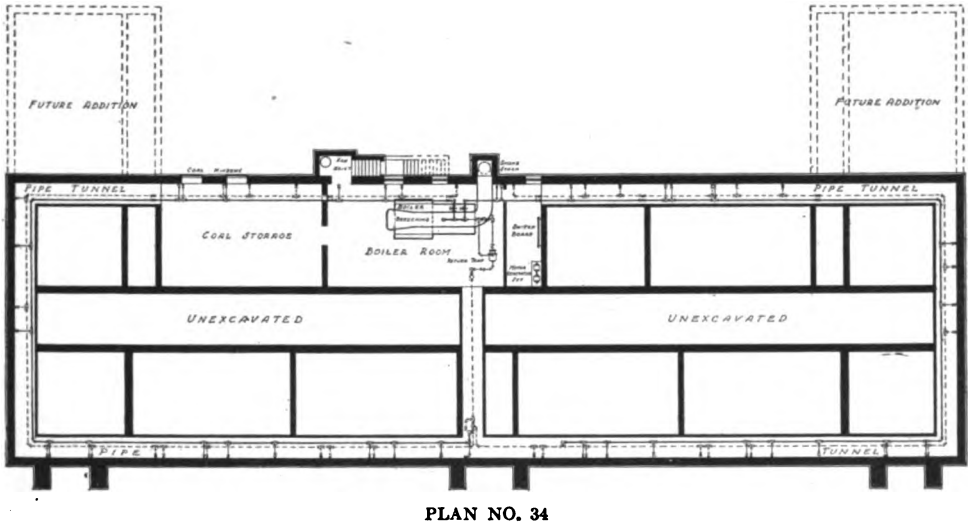
PLAN NO. 34
BASEMENT PLAN OF FOURTEEN-CLASS-ROOM SCHOOLHOUSE, SHOWING SPLIT STEAM-HEATING AND VENTILATING SYSTEMS

PLAN NO. 34
GROUND-FLOOR PLAN OF FOURTEEN-CLASS-ROOM SCHOOLHOUSE

Digitized by Google

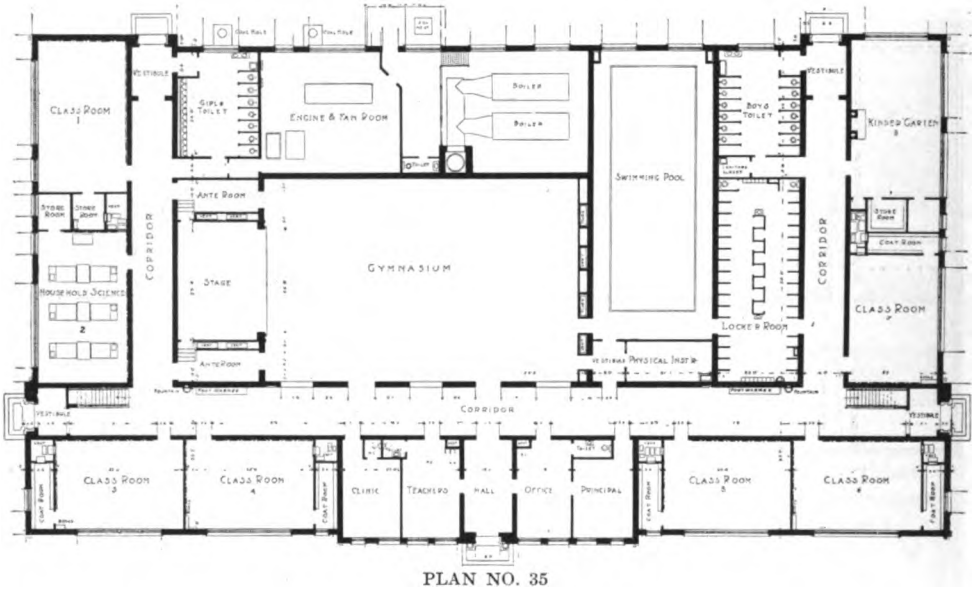


PLAN NO. 34
FIRST-FLOOR PLAN OF FOURTEEN-CLASS-ROOM SCHOOLHOUSE



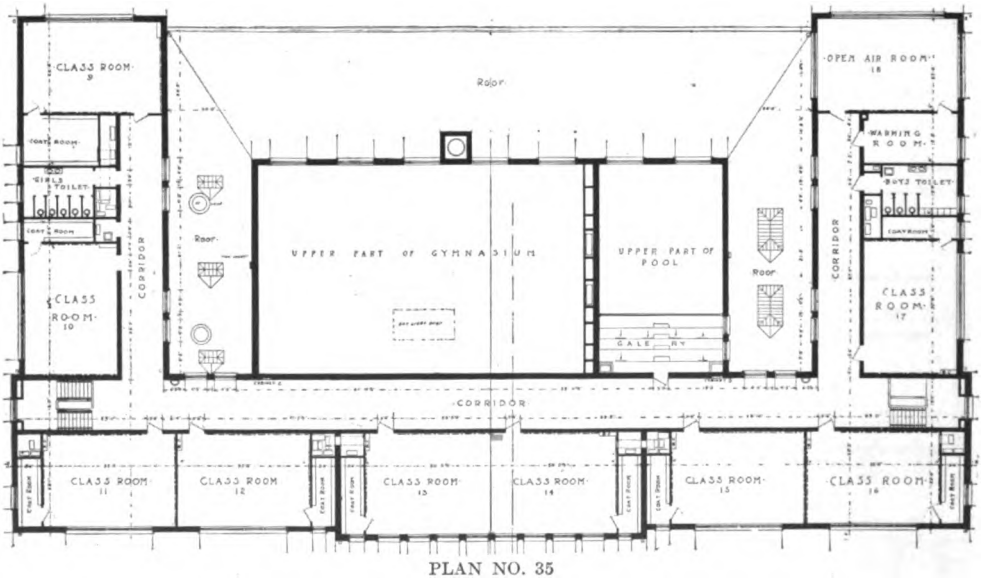
PLAN NO. 34
BASEMENT PLAN, SHOWING UNIT HEATING AND VENTILATING SYSTEM, WITH BASEMENT UNEXCAVATED EXCEPT FOR TUNNELS, BOILER ROOM, AND COAL STORAGE

Digitized by Google



PLAN NO. 35

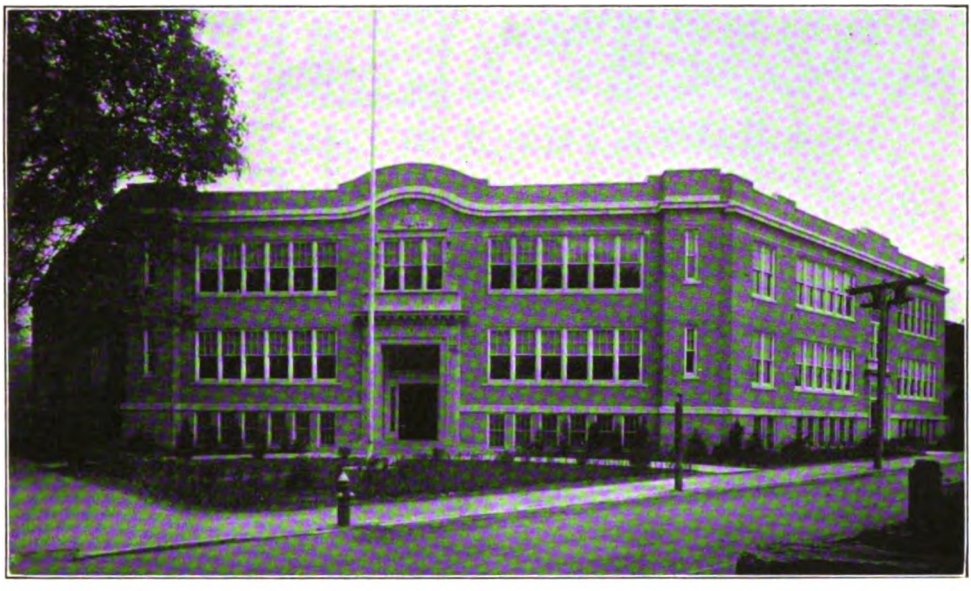
GROUND-FLOOR PLAN OF JUNIOR HIGH SCHOOL OF EIGHTEEN CLASS ROOMS



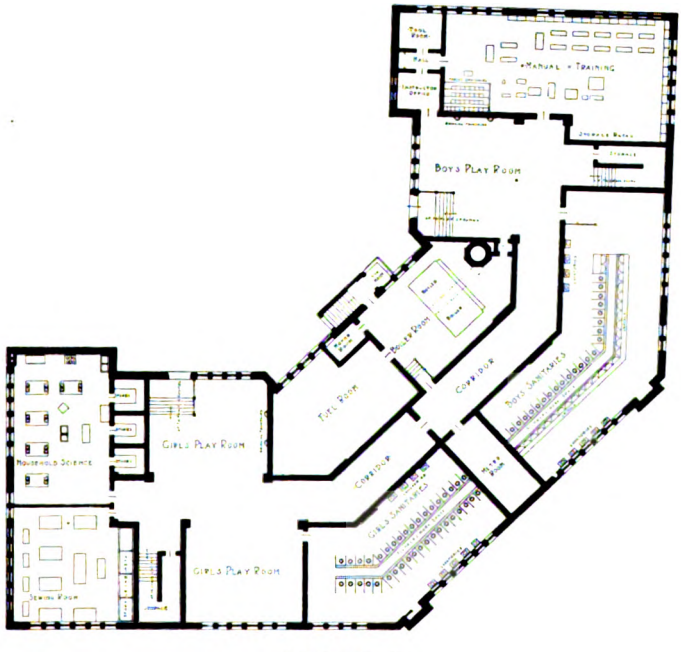
PLAN NO. 35

FIRST-FLOOR PLAN OF JUNIOR HIGH SCHOOL OF EIGHTEEN CLASS ROOMS

Digitized by Google

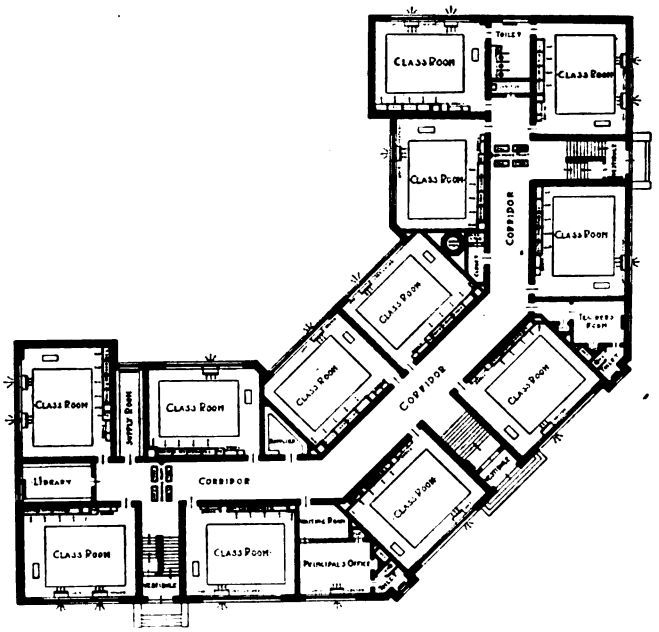


PLAN NO. 36
EXTERIOR VIEW OF A TWENTY-FOUR-CLASS-ROOM JUNIOR HIGH SCHOOL

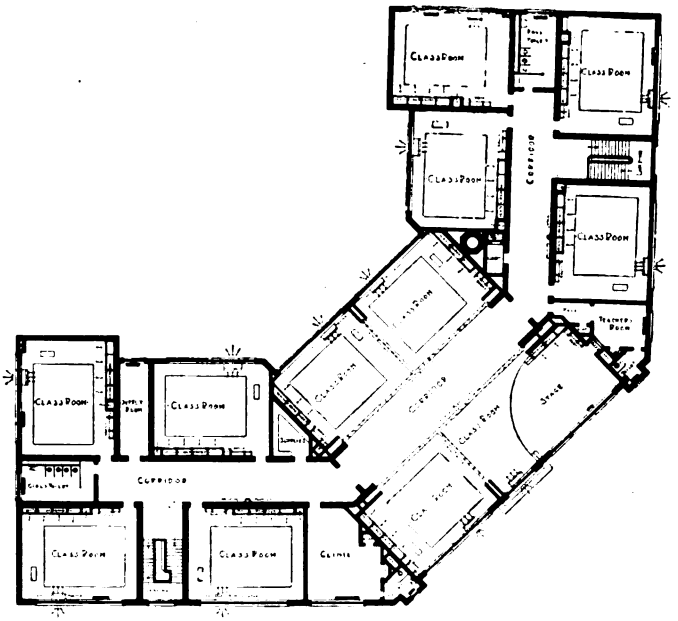


PLAN NO. 36
BASEMENT PLAN OF A TWENTY-FOUR-CLASS-ROOM JUNIOR HIGH SCHOOL

Digitized by Google



PLAN NO. 36
GROUND-FLOOR PLAN OF A TWENTY-FOUR-CLASS-ROOM JUNIOR HIGH SCHOOL

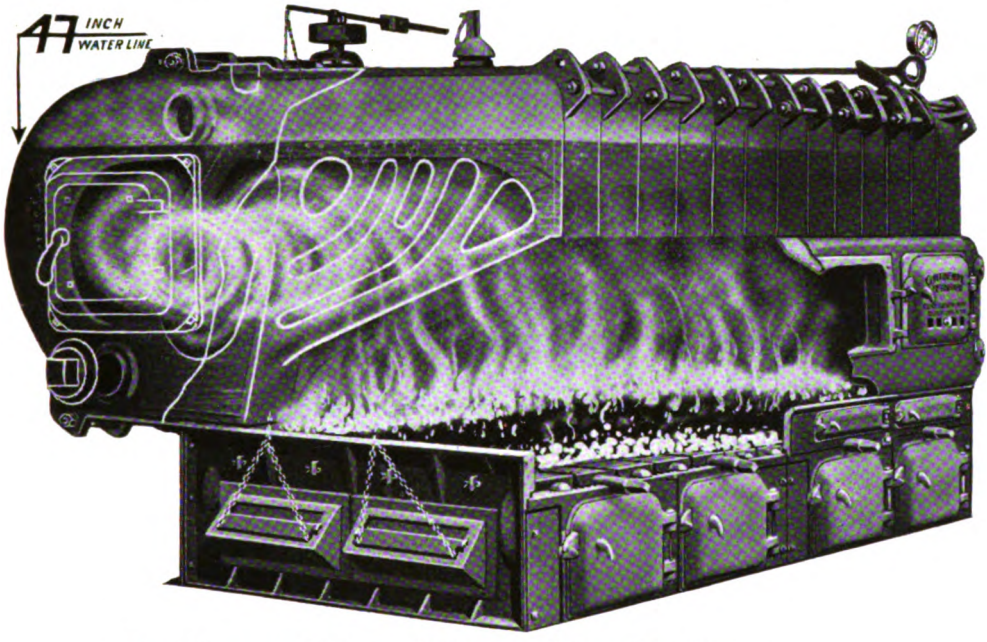


PLAN NO. 36
FIRST-FLOOR PLAN OF A TWENTY-FOUR-CLASS-ROOM JUNIOR HIGH SCHOOL

Digitized by Google

Continental

BOILERS & RADIATORS



Continental Low Water Line Boilers are "made to order" for schools

The installation, fuel and labor savings of Continental Low Water Line Boilers have earned a self-made reputation for unusual economy under the demands of school heating.

Continental 43- and 47-inch water lines eliminate refuse-gathering pits—clean basements reduce the fire hazard.

Continental Low Water Line Boilers are easy to fire — janitors like them.

Grate bars shake in series of twos and threes—perfect fire control means maximum fuel economy.

Balanced draft doors are easily operated by the most sensitive regulator — accurate temperature control means a better health average.

Free and balanced circulation with water tubes in direct contact with flames make them quick steamers—no cold classrooms on Monday morning.

Accessible design of grate bars permits easy removal and replacement — saves maintenance and repair charges.

From the architect specializing in school design right down to the man who fires the boiler, everybody appreciates the many Continental features that make them literally made to order for schools.

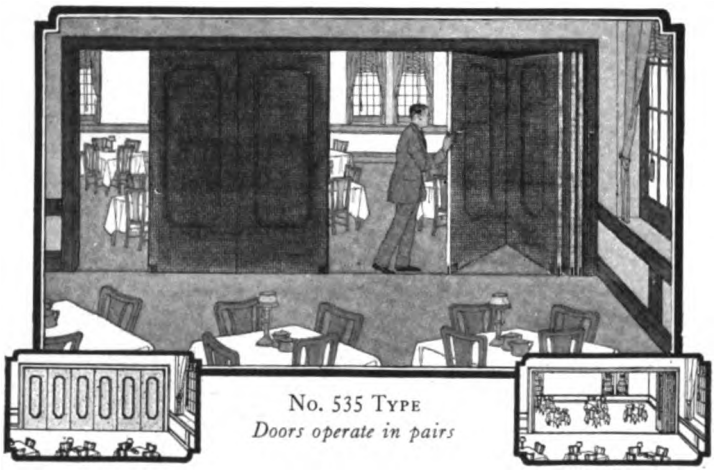
This valuable book gives all the data on Continental Boilers and Radiators. A request will bring your copy.

Continental Heater Corporation
Home Office and Factory
Dunkirk N. Y. U.S.A.

BUILT · FOR · BETTER · HEATING

See Page 91, Par. 174

Digitized by Google



No. 535 Type
Doors operate in pairs

R-W
Folding Partition Door Hardware

Doors are hinged together in pairs and each pair is operated as an independent unit. Entire load is carried on the floor track. Recent New York City installations include:

Julia Richmond High School — Thomas Jefferson High School
James Madison High School — New Utrecht High School
Girls' Commercial High School

Many other prominent schools in New York State are also R-W equipped.

R-W No. 237 Folding Partition Door Hardware operates the doors similar to the No. 535, except the weight of the doors is carried in the upper track.

Other R-W Schoolhouse Equipment is as follows:

Wardrobe Door Hardware
Accordion Door Hardware
Flush and Parallel Door Hardware
Stair Rail Brackets
Manual Training Benches
Rapid Acting Vises
Swing Door Checks

(R-W No. 430 Vise)

New York
Boston
Philadelphia
Cleveland
Cincinnati
Indianapolis
St. Louis

Richards-Wilcox Mfg. Co.
A Hanger for any Door that Slides
AURORA, ILLINOIS, U.S.A.
RICHARDS-WILCOX CANADIAN CO., LTD.
Winnipeg LONDON, ONT. Montreal

Chicago
Minneapolis
Omaha
Kansas City
Los Angeles
San Francisco
Seattle

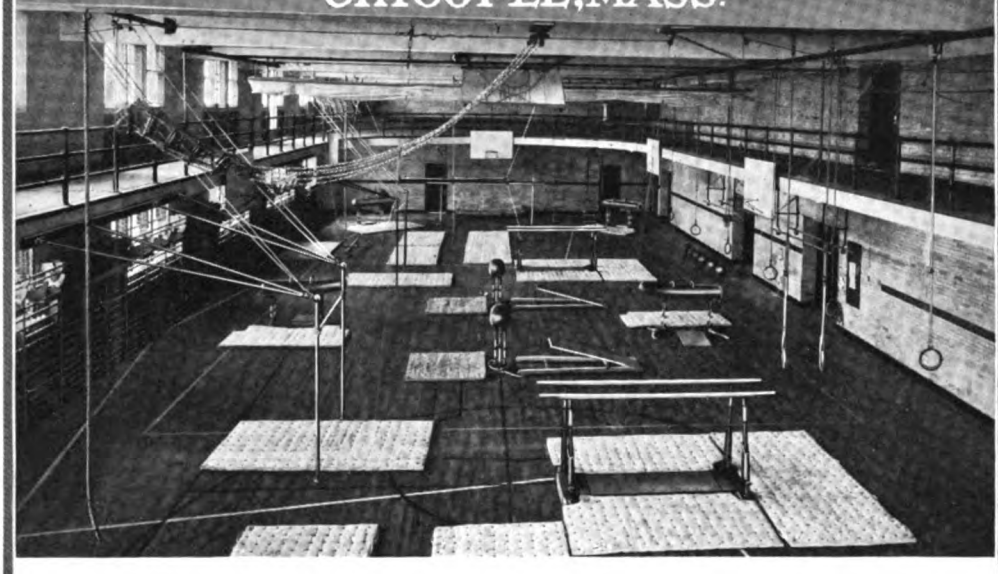
(707)

See Page 73, Par. 147

Digitized by Google

A.G.SPALDING & BROS.

·Recreation Engineers·
·Gymnasium & Playground Outfitters·
CHICOPEE, MASS.



School Boards, School Officials and Architects are cordially invited to consult us regarding approved gymnasium construction and equipment, either prior to completion of plans or during course of construction. This service is freely and gladly given and imposes no obligation. We are interested in the building of "good" gymnasiums.

A. G. Spalding & Bros.

Chicopee, Mass.

Making a specialty of Efficient Gymnasiums for High Schools and Colleges

Makers also of "Time-Tested" Apparatus for Playgrounds

See Page 56, Par. 107

Digitized by Google

WALBRIDGE & CO.

GOOD HARDWARE AND SPORTING GOODS

PHONE SEN. 9360 **BUFFALO** COURT & FRANKLIN

FINISHING HARDWARE
for
SCHOOLS *and* PUBLIC BUILDINGS

OUR SPECIALTY

We are in a position to give the very best service and advice on all questions pertaining to

Builders' Hardware

OUR PRICES ARE CONSISTENT
WITH THE QUALITY

We represent the best known manufacturers

Yale & Towne, Norwalk Lock Co., Stanley Works,
Ives, Richards-Wilcox, Vonnegut,
Payson, Rixson and others.

INQUIRIES SOLICITED

See Page 42, Par. 80

Digitized by Google

El Paso, Texas, High School

Electrical Equipment for Schools

At the El Paso High School of El Paso, Texas, *Westinghouse Motors* and *Controllers* are used to operate the ventilating equipment, as well as the woodworking and other machine tools.

Ventilating Motors and Controllers

Westinghouse early recognized the necessity of an adequate ventilating system for schools. Each installation was studied, data was compiled, and research work was carried on so that we are in an excellent position to furnish equipment that is right in every detail.

Headstock Motors and Controllers

Westinghouse Headstock Motors and Controllers were specially designed and built to operate woodworking machines that are used in manual training departments. Where used, students are instructed in the use of the most modern woodworking equipment and they benefit further by the greater convenience and safety of operation of the machines.

Write our nearest district office for further information regarding complete electrical equipment for schools.

Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

Sales Offices in all Principal American Cities

WESTINGHOUSE ELECTRIC

Westinghouse

See Page 79, Par. 155

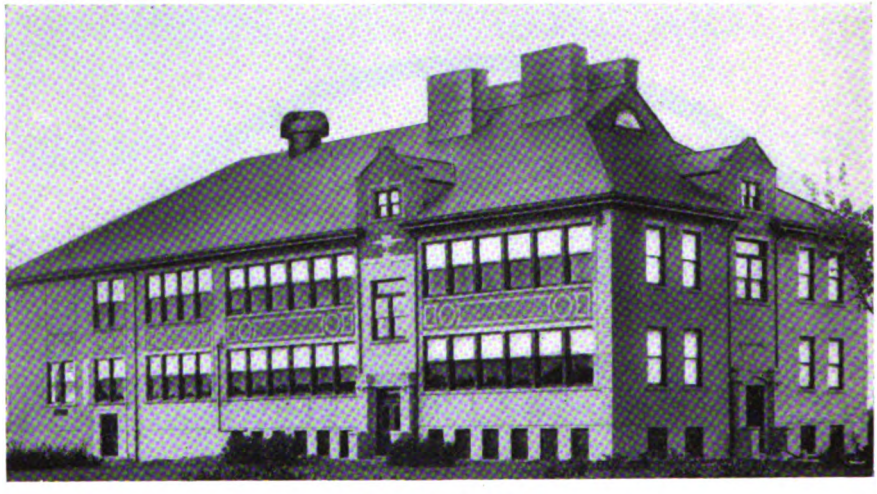
Digitized by Google

EFFICO

ROTARY BALL (Oil Flooded) BEARING FAN EQUIPPED

ROOF VENTILATORS

(PATENTED)



School, Barker, N. Y.

The above school is equipped with one EFFICO, which is taking care of entire ventilation; the suction fan is 105 inches in diameter. Note pleasing lines of ventilator.

Several hundred schools of various sizes are now ventilated by EFFICOS.

We are pleased to co-operate with your architect in designing the ventilation of your new school; also, without charge, will survey and make recommendations to improve conditions in buildings now illy ventilated or troubled with back-drafts.

W. F. HIRSCHMAN CO. INC. LE ROY, N. Y.

See Page 89, Par. 171

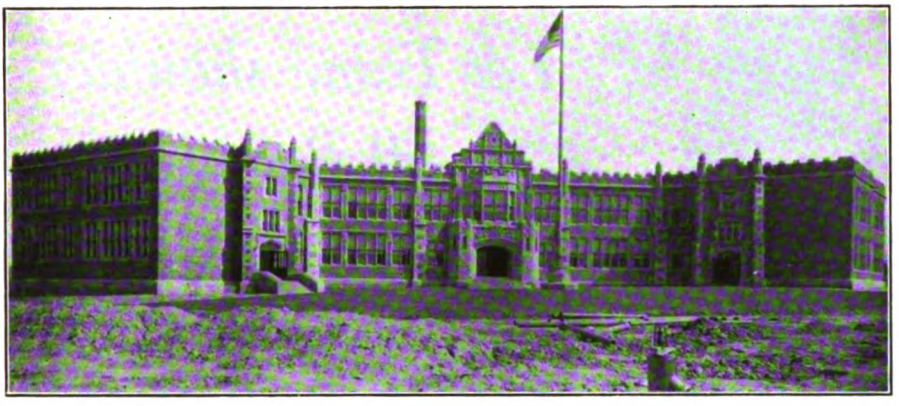
Digitized by Google

TAYLOR ROAD SCHOOL

CLEVELAND HEIGHTS, OHIO

ARCHITECT
Franz C. Warner, Cleveland, O.

STONE
"Buckeye Gray" Sandstone



The Board of Education of Cleveland Heights, Ohio, is developing school buildings that are becoming nationally known as to architecture and efficiency. Taylor Road School is one of five school buildings recently completed, in all of which they have used "Buckeye Gray" Sandstone.

"Buckeye Gray" Sandstone is what is geologically known as a siliceous sandstone, analyzing approximately 95% pure silica, and should not be confused with other classifications of sandstone, the cementing qualities of which are carbonate of lime, iron oxide or clay-like substance. It is the presence of a large percentage of silica in the rock that gives it wonderful enduring qualities. It is of a fine and even texture, uniform in color.

As a fire resistant "Buckeye Gray" Sandstone is the most perfect stone produced. The fact that thousands of tons of it are used annually by steel companies for lining their furnaces where it is subjected to intense heat verifies this assertion.

"Buckeye Gray" Sandstone will not stain by Portland Cement Mortar, and therefore, does not require any special treatment to prevent discoloration from any elements in the mortar; nor is it necessary to paint the backs of the stone.

Use "Buckeye Gray" Sandstone in your School Buildings and be assured of obtaining a Durable and Beautiful Material.

THE OHIO QUARRIES COMPANY

UNION TRUST BUILDING CLEVELAND, OHIO

Digitized by Google

Trane Radiator Trap

Let Trane shoulder all the heating responsibility

One of the older tendencies in heating was toward buying the system in parts. Pumps came from one source, radiator traps from another, etc. The plan was not desirable because it fostered divided responsibility.

In the Trane System of Vacuum Heating you have an opportunity to depend upon the pumps and specialties of but one manufacturer. The system is 100% Trane; and the responsibility is all Trane's, too. Trane Vacuum Heating will exceed your most anxious expectations.

We will welcome an opportunity to give you complete information on this most important subject.

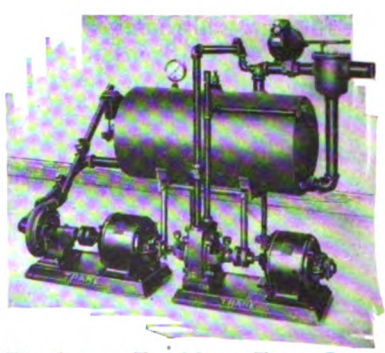
The Trane Company

La Crosse, Wis.

Established 1885

Factories at La Crosse and Toronto, Ont.

Branch offices throughout the U. S. A.; in Canada, England, Japan and China.



The famous Two-Motor Trane Return Line Special Vacuum Pump. Especially desirable for schoolhouse work.

See Page 31, Par. 50

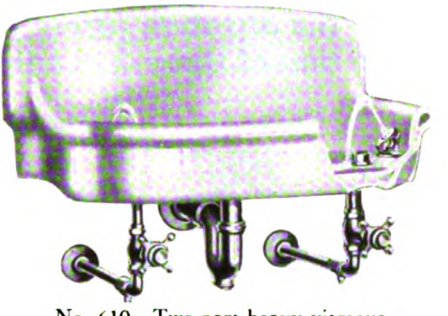
Digitized by Google

Automatic Stream Control

HALSEY TAYLOR DRINKING FOUNTAINS

Sanitary Two-Stream Projector

SCHOOL authorities and architects who have certain plans to meet in the installation of drinking water equipment will find that in specifying Halsey Taylor Drinking Fountains they secure the benefit of a complete variety of types to meet any particular need. This is just one reason why it pays to install Halsey Taylor Drinking Fountains, the most sanitary types possible to secure. *Automatic Stream Control*, assuring uniform height of water regardless of pressure variation; *practical drinking stream*, keeping lips away from source of supply and preventing contamination; *non-squirting feature*, making it impossible to squirt water on floors —these are features found in no other make!



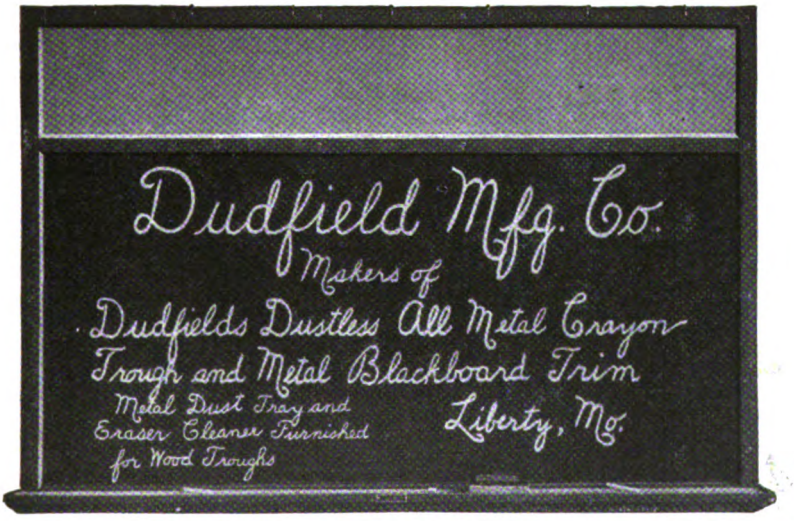
No. 610—Two-part heavy vitreous china wall fountain, with integral back

THE HALSEY W. TAYLOR COMPANY, WARREN, O.

BRANCHES

NEW YORK CITY
210 East 45th St.
PHILADELPHIA
5224 Greene St.
CHICAGO
1702 N. Talman Ave.
KANSAS CITY
202 Baltimore Bldg.
SAN FRANCISCO
237 Rialto Bldg.
LOS ANGELES
2131 East Ninth St.
DENVER
401 Jacobson Bldg.
BOSTON
46 Cornhill, Room 512
ATLANTA
322 N. Jackson St.

See Page 61, Par. 120



The Most Sanitary Equipment for all Blackboards

WE MANUFACTURE A SPECIAL DUSTLESS METAL TROUGH FOR REMODELING OLD SCHOOLS

Representative
FORD B. HANNA
405 Lexington Ave., N. Y. City

See Page No. 31, Par. 50.
Samples and description in detail furnished on request

DUDFIELD MFG. CO.
LIBERTY, MO.

See Page 31, Par. 50

Digitized by Google

YOUR RESPONSIBILITY

Does not end **until you have provided for the *absolute safety* as well as for the education of those depending upon your judgment.**

A Standard Spiral Fire Escape

Does provide a safe means of escape —

Its high guardrails shield the passengers from flame and smoke.

It has a greater capacity than any other type.

It has other features of safety which you should investigate.

Has proper provision been made to safeguard the children under your protection?

Send for Catalog H. It gives complete information on Standard Fire Escapes.

STANDARD CONVEYOR COMPANY.

NORTH ST. PAUL, MINN.

See Page 43, Par. 86

Digitized by Google

-JOHNSON- JSC -SYSTEM-

No system of heating and ventilating is complete and adequate without automatic temperature regulation.

The Stability of the Johnson Service Company and the exclusive merits of the Johnson Heat and Humidity Control, offer the greatest value in automatic temperature regulation.

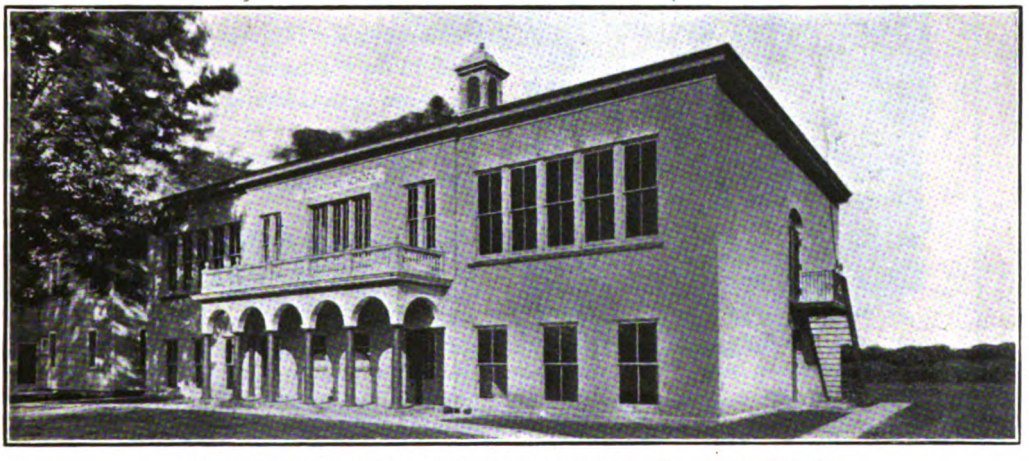
The metal diaphragms in the thermostats, and the "Sylphon" bellows in the valves of the Johnson System assure durability and freedom from trouble.

Architects find that the Johnson System affords perfect thermostatic regulation.

JOHNSON SERVICE COMPANY
Milwaukee Wisconsin

TEMPERATURE JSC REGULATION

See Page 89, Par. 172



WATERPORT HIGH SCHOOL—WATERPORT, NEW YORK.
BUILT OF

EMPSTONE MAGNESITE STUCCO

EMPSTONE is an all-mineral stucco containing no lime, gypsum or portland cement. It is especially good for schools because it is warm and substantial and presents a good-looking appearance. It is absolutely fireproof and impervious to heat and cold. EMPSTONE construction costs much less than brick or stone and is quickly applied at great labor saving. It is manufactured under the most rigid chemical supervision. Write us for samples and your dealer's name.

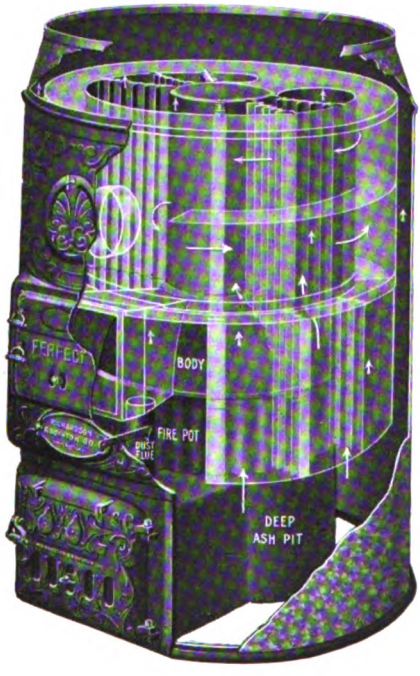
EMPIRE STUCCO MAN'F'G. CORP'N., North Tonawanda, N. Y.

See Page 70, Par. 142

Digitized by Google

Heating Schools with Fresh Warm Air

THE Richardson Mechanical System Heater forces sufficient fresh warm moist air to every room in the schoolhouse to permit from three to seven changes per hour, according to requirements. Due to this, buildings may be warmed in 90 minutes after the heater has been in operation, maintaining an *even* temperature in every room, continuously.



No drafts—complete ventilation. A high temperature is not necessary with this heater; therefore the consumption of fuel is correspondingly reduced. The Hot Blast Attachment assures complete combustion even with cheaper grades of coal. Installed at much less cost than indirect steam or other methods. Complies with every State law on ventilation. Richardson Heater Ratings are conservative. Heaters are guaranteed to do the heating work claimed for them satisfactorily and economically.

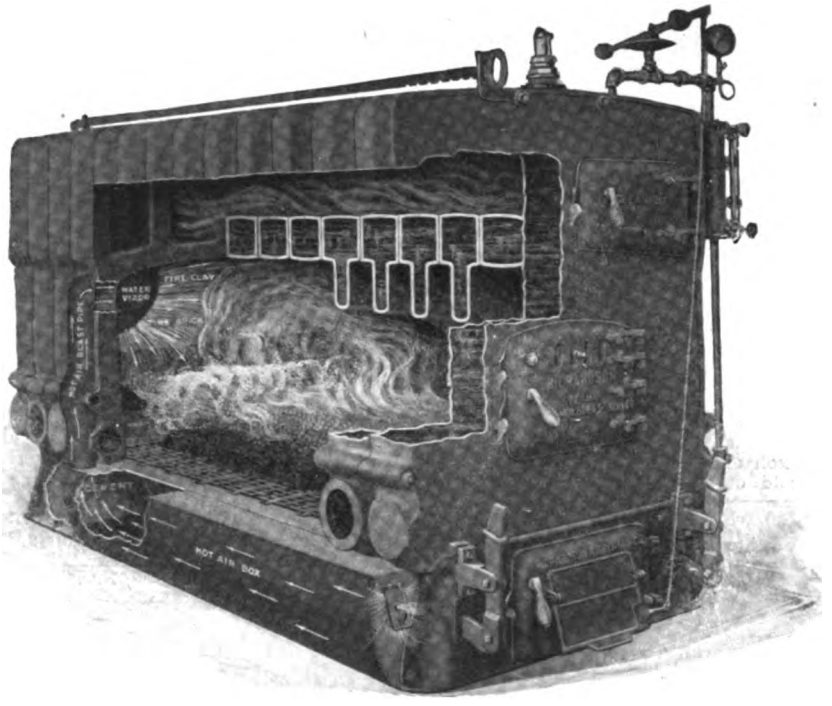
Richardson & Boynton Co.
JACKSON BUILDING
220 DELAWARE AVENUE
Buffalo, N. Y.

RICHARDSON
Mechanical System Heaters

See Page 80, Par. 157

Digitized by Google

Better School Heating



BETTER School Heating with RICHARDSON Hot Blast Smokeless Boilers.

The "Y" Flue construction equalizes circulation and assures a steady water line. Overhanging Prime Heating Surfaces are at the maximum, producing the highest evaporative power. Gases cannot accumulate or explode, due to the two portholes at the top center of large chamber in front of bridgewall. The natural fire travel and draft do away with the necessity of excessively tall chimneys. Long flue travel aids combustion and assures maximum heat from fuel. This boiler may be easily installed in new or old buildings.

Richardson Boiler Ratings are conservative. Richardson Boilers are *guaranteed* to be perfect in manufacture to do the heating work claimed for them satisfactorily and economically.

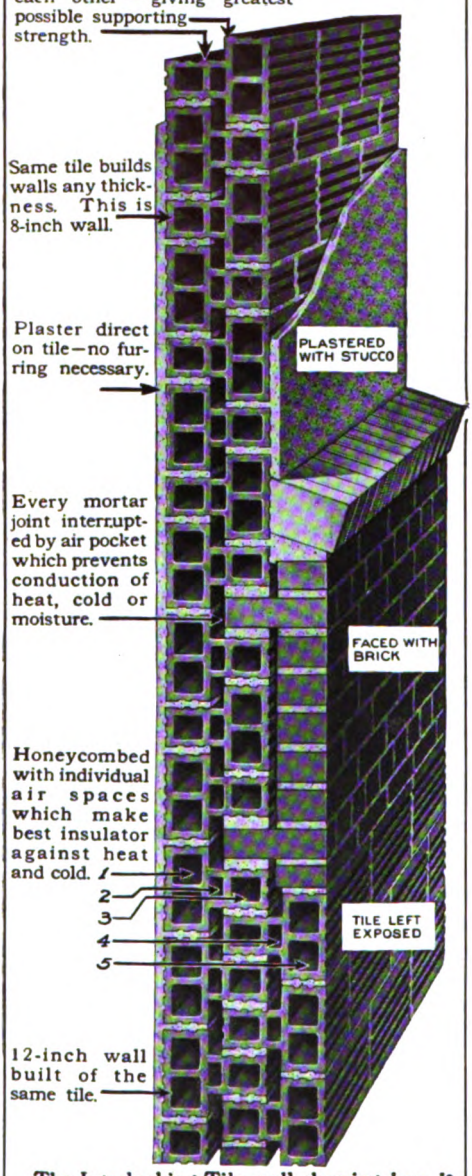
RICHARDSON & BOYNTON CO.

JACKSON BLDG., 220 DELAWARE AVE.

BUFFALO, N. Y.

See Page 91, Par. 174

Digitized by Google


Partitions always directly over each other — giving greatest possible supporting strength.
Same tile builds walls any thickness. This is 8-inch wall.
Plaster direct on tile—no furring necessary.
Every mortar joint interrupted by air pocket which prevents conduction of heat, cold or moisture.
Honeycombed with individual air spaces which make best insulator against heat and cold.
1
2
3
4
5
12-inch wall built of the same tile.
PLASTERED WITH STUCCO
FACED WITH BRICK
TILE LEFT EXPOSED

The Interlocking Tile wall showing how it can be built in different thicknesses and faced with stucco, brick or left exposed.

Sales Agents

Empire Builders' Supply Company

Gluck Building,
NIAGARA FALLS, N. Y.

See Page 70, Par. 142

BRADLEY WASHFOUNTAINS

For use in schools, colleges, universities and every type of public lavatories, no fixture equals the Bradley Washfountain in utility, durability, beauty and economy of operation and maintenance.

Promotes cleanliness and sanitation. Requires a minimum of janitor service.

Write for catalogue and further information.

Bradley Washfountain Company
MILWAUKEE, WISCONSIN.

See Page 59, Par. 116

Holtzer-Cabot

Signal Systems for Schools

Holtzer-Cabot equipment is used as a standard by leading schoolhouse authorities and adopted exclusively by many large cities.

Our brochure, the most complete ever published on signal systems for schools, will be gladly sent to all parties interested.

See page 72 ¶142 in the text of this edition.

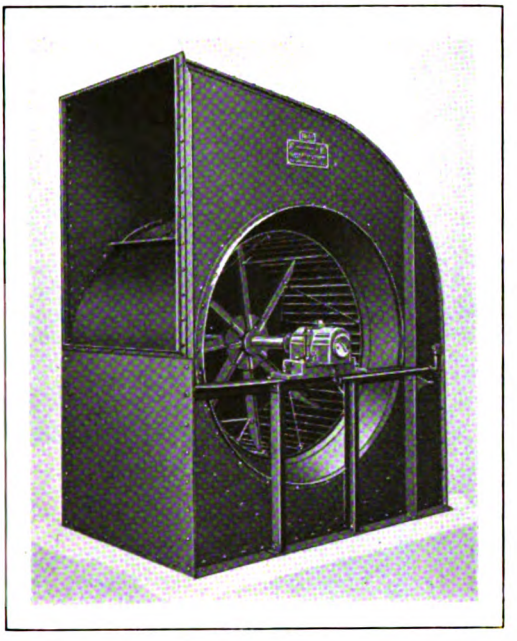
THE HOLTZER-CABOT ELECTRIC CO.

BOSTON, MASS.,

Chicago	New York	Baltimore
Philadelphia	San Francisco	Cleveland
Detroit	St. Louis	Minneapolis

See Page 72, Par. 142

Digitized by Google



To Architects:

The NEW Type HV Fan, with a maximum efficiency of 77%, is the most economical ventilating unit on the market today. It is strictly the product of advanced engineering. It has been thoroughly tested and is guaranteed by the Clarage Company to perform exactly as rated. Write for Reference Book 53 giving full information on this remarkable equipment.

A New Standard of Comparison

Size for size, compared with every other multiblade fan for schoolhouse ventilation, the NEW Clarage Type HV Fan *always costs less* to operate.

The reason for a lower operating cost lies in the high efficiency of the HV Fan, which allows a saving in power of 15 to 20% on *every* job. And since the power requirement is decreased, it is usually possible to drive the HV Fan with a *smaller* size motor — *another substantial saving.*

An opportunity is also presented to save on the first cost of the fan equipment, as this HV Fan, *one size smaller*, will meet the architect's specifications in practically all cases.

This NEW Clarage Fan is a low speed type — silent in operation.

* * *

The school board anxious to enforce *strictest* economy, but not at the expense of quality and reliability, should closely investigate this Clarage product. The Clarage organization has been in existence over fifty years and hundreds of satisfactory installations have been made in your state and adjacent territory.

Write for full particulars to the Clarage branch office nearest you, as listed below.

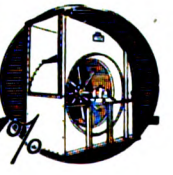
CLARAGE FAN COMPANY

HOME OFFICE AND WORKS: KALAMAZOO, MICH.

New York City, 149 Broadway — Buffalo, 520-22 White Bldg.
Pittsburgh, 206 Wood St. — Philadelphia, 627 Commercial Trust Bldg.

CLARAGE MULTIBLADES

New Type HV maximum efficiency 77%



See Page 88, Par. 167-168

Digitized by Google

TRUSCON Donovan Awning Type Windows are one of a complete line of Steel Windows made by Truscon including Projected, Counterbalanced, Double-Hung, Standard Casements, Basement Windows, Pivoted and Continuous Sash and Mechanical Operators.

Windows that Guard Health

Truscon Donovan Awning Type Windows are especially designed for use in schools. They permit full daylighting and maximum ventilation. By putting shades on individual sashes, glare of direct sunlighting may be eliminated without interfering with daylighting. This is in contrast to the practice of pulling shades over windows, and reducing the daylighting by over half the legal requirement. Truscon Donovan Awning Type Windows conserve eyesight and general health.

Write for Donovan Window Catalog

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

NEW YORK STATE OFFICES

31 Union Square, New York City — *440 Gurney Bldg., Syracuse, N. Y.*

100 State Street, Albany, N. Y. — *726 Genesee Bldg., Buffalo, N. Y.*

TRUSCON

DONOVAN

AWNING TYPE WINDOWS

See Page 28, Par. 41

Digitized by Google

FIVE A DAY

Is the appalling toll of schools exacted by fire each day!

The best way to reduce this is to prevent fires from starting. The next best way is to confine a fire to its point of origin.

Fireproof walls, floors and ceilings do not make a fireproof building. Give them a chance to do what you expect of them. Back them up with metal doors and trim.

There is enough combustible material in the average school to eat through wooden doors.

Dahlstrom Metal Doors and Trim have been doing their part in protecting our future citizens for more than twenty years.

Dahlstrom Metallic Door Company

Jamestown, N. Y.

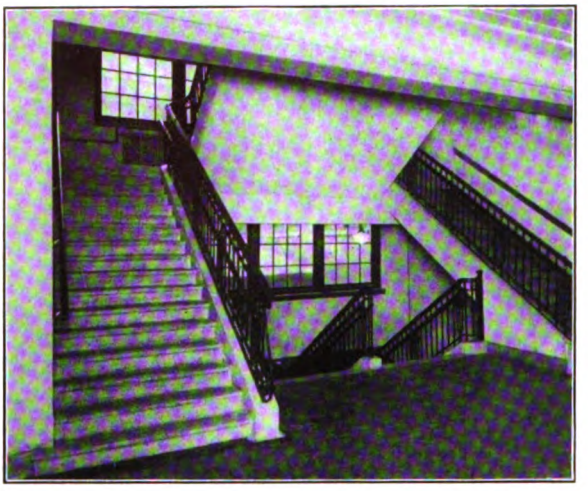
NEW YORK **CHICAGO** **DETROIT**

Established 1904

See Page 41, Par. 77

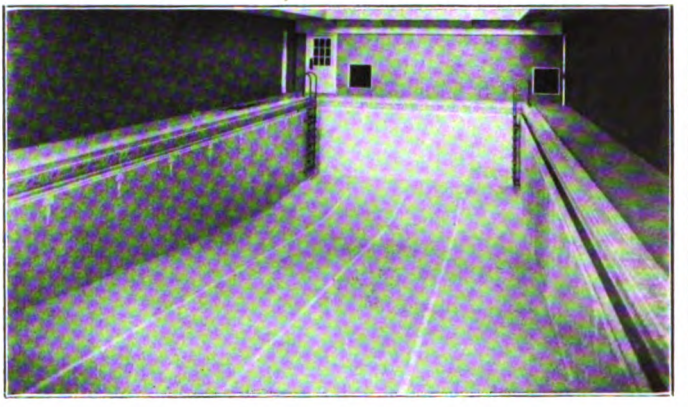
Digitized by Google

Italian Mosaic & Marble Company, Inc.



Terrazzo stairs with Alundum chips for non-slipping purposes installed at the new Niagara Falls High School.

Tile swimming pool installed at the new Cleveland Avenue School at Niagara Falls.



WE HAVE installed Terrazzo, Tile, Marble, Slate and Magnesite Composition work in hundreds of schools in recent years throughout the United States and Canada. ¶ We would be pleased, at all times, to receive your inquiries for the installation of these materials which are now being used so extensively in modern schools for stairways, corridors, classrooms, swimming pools and toilets. We are always prepared to suggest the proper use of these materials and make up sketches and samples for you at your request.

ITALIAN MOSAIC AND MARBLE CO., INC.

112 CHURCH STREET, BUFFALO, NEW YORK

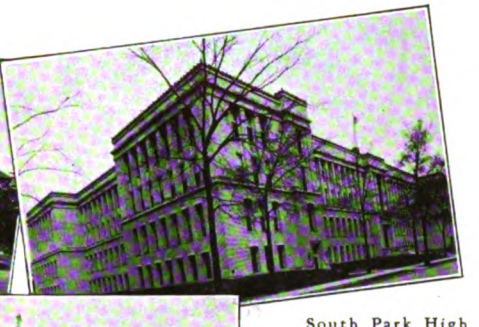
Branches: Toronto, Ontario London, Ontario Montreal, Quebec

See Page 58, Par. 115

Digitized by Google

25 schools in Buffalo are equipped with Standard Electric Time Systems

Elementary School No. 65, Buffalo, N. Y. Associated Buffalo Architects. Wm. B. Ittner, Associate.



South Park High School, Buffalo, N. Y. Architects, Green & Wicks, Buffalo.

Primary School No. 64, Buffalo, N. Y. Associated Buffalo Architects. William B. Ittner, Associate.

Some other Buffalo installations:

Elementary School No. 3
Elementary School No. 11
Elementary School No. 13
Elementary School No. 21
Elementary School No. 60
Elementary School No. 61
Elementary School No. 69
Elementary School No. 70
Elm Vocational School
McKinley Vocational School
Nichols School
Canisius College

"Standard" is sold, installed, and serviced under a system that insures satisfactory results. Ask your Architect to specify "Standard" and see that the Contractor furnishes it. Specifications or other information gladly furnished.

Country-wide service

60% of all schools having Electric Time Equipment use "Standard"

The Standard Electric Time Company

SPRINGFIELD, MASS.

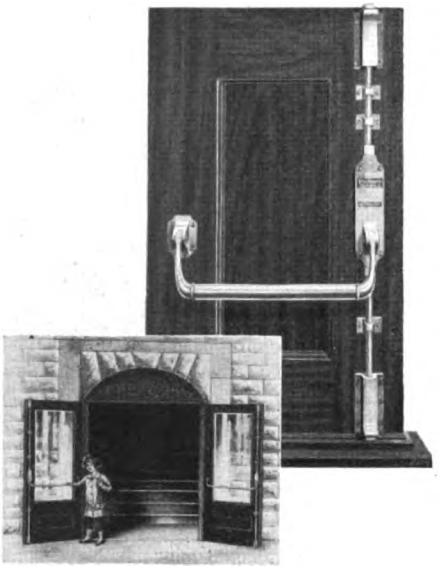
NEW YORK STATE BRANCHES:

901 Mutual Life Bldg., Buffalo, N. Y. *and* 50 Church Street, New York City

Branches in all principal cities

See Page 77, Par. 152

Digitized by Google



"Safe Exit is a Universal Demand"

Von Duprin

SELF-RELEASING FIRE EXIT DEVICES

These devices are manufactured with the idea that every device must be so reliable that it will stand up under the wear of vigorous daily service—and still have the reserve strength to meet any possible emergency demand.

ASK US FOR CATALOG 24-X.

Price on request.

Manufacturers

Vonnegut Hardware Co.

Indianapolis, Ind.

See Page 42, Par. 81

For the inspirational aspect of

school buildings

We list school buildings in New York State that owe to Norristone cut-cast granite qualities of beauty and endurance.

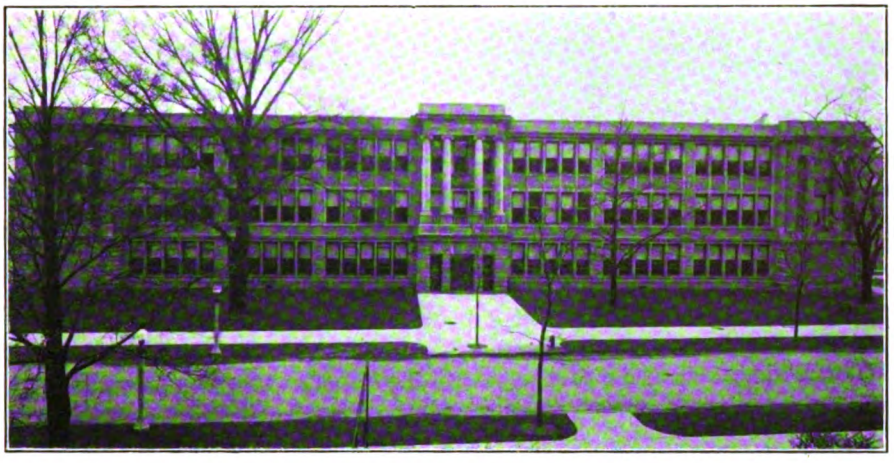
Irondequoit	Irondequoit	Grade School	Phelps
St. Mary's School	Medina	Union School	Marion
Medina High School	Medina	High School	Ithaca
Grade School	Sinclairville	Grade School	Gardenville
Cassadaga School	Cassadaga	High School	Fairport
Grade School	Ithaca	High School	Greece
Long Avenue School	Tonawanda	Grammar School	Collins
E. Rochester School	E. Rochester	High School	Webster
St. Boniface's School	Rochester	St. Patrick's School	Seneca Falls
St. Bernard's Seminary	Rochester	High School	Bergen
Salem Evangelical School	Rochester	Grade School No. 18	Rochester
Eastman School of Music	Rochester	Grade School No. 19	Rochester
St. Clairville School	Jamestown	Grade School	Newark

The best way to view any building material is to see it as part of the finished job. We would like also to acquaint you with that other Norristone quality—its economy.

Norristone CUT-CAST Granite

107 NORRIS ST. Rochester, N. Y. 823 ELLICOTT SQUARE Buffalo, N. Y.

Digitized by Google



Sturtevant Ventilating Equipment installed in Jefferson Junior High School, Rochester, N. Y.
Gordon & Madden, Architects — *Laube Electrical Construction Co., Contractors*

Sturtevant Equipment for Schools

Every day gives added evidence to the superiority of the Forced Blast System for heating and ventilating schoolhouses. In first cost, operating cost, maintenance cost, and results achieved the Forced Blast System still remains supreme.

Sturtevant Forced Blast Equipment operates from one central station and is a distinct advantage over all other types of heating and ventilating equipment. The air is thoroughly washed by Sturtevant Air Washers and distributed by Sturtevant Silentvane Fans. By this means pure air is continuously supplied and a constant even temperature is maintained.

Sturtevant Air Washers have non-clogging nozzles, and specially designed louvers to prevent "back splash" and Sturtevant Silentvanes run with less noise at higher speeds than any other fan used in ventilation work.

Evidence of the superiority of Sturtevant Forced Blast Equipment lies in the fact that installations in New York schools alone, exceed by far the hundred mark and are operating satisfactorily.

To school officials, the subject of schoolhouse cleaning is also of great importance.

Schoolhouse cleaning is no longer a problem where Sturtevant Stationary Suction Sweeping Systems are installed, because the Sturtevant successfully meets the cleaning requirements of the modern schoolhouse.

The Sturtevant has only one moving part—a motor, and a series of fans revolving as a unit on the same shaft. The efficient dust-separating arrangement prevents dust from reaching fans or bearings, thereby eliminating all chance of clogging and unbalancing.

With such construction—even, constant, powerful suction is certain, and maximum results are obtained at extremely low operating and maintenance costs.

B. F. STURTEVANT COMPANY

Sales Engineering Offices

Atlanta, Ga.
Boston, Mass.
Buffalo, N. Y.
Camden, N. J.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Dallas, Texas
Denver, Colo.
Detroit, Mich.
Hartford, Conn.
Indianapolis, Ind.
Kansas City, Mo.
Los Angeles, Cal.
Minneapolis, Minn.
Montreal, P. Q.
New York City
Pittsburgh, Pa.
Portland, Ore.
Rochester, N. Y.
St. Louis, Mo.
Salt Lake City, Utah
San Francisco, Cal.
Seattle, Wash.
Toronto, Ont.
Washington, D. C.

Plants located at

Hyde Park, Mass.
Sturtevant, Wis.
Berkeley, Cal.
Framingham, Mass.
Camden, N. J.
Galt, Ontario

Sturtevant
PUTS AIR TO WORK

Foreign Representatives

Sturtevant Engineering Co. Ltd. — London
Sturtevant Cie — Paris
American Trading Co. — Tokio
American Trading Co. — Shanghai
Cotton Neill Eng. and Mach. Co. — Manila
Honolula Iron Works Co. — Honolula T. H.
H. P. Gregory & Co., Ltd. — Sydney
Blair, Reed & Co., Ltd. — Wellington
Wesselhoeft & Poor — Caracas
Wesselhoeft & Poor — Bogota
General Machinery Co. — Tampico
Pedro Martinto, Inc. — Lima
Compania Italo-Americano de Importacion — Buenos Aires
A. E. Barker — Johannesburg

1210

See Page 86, Par. 165

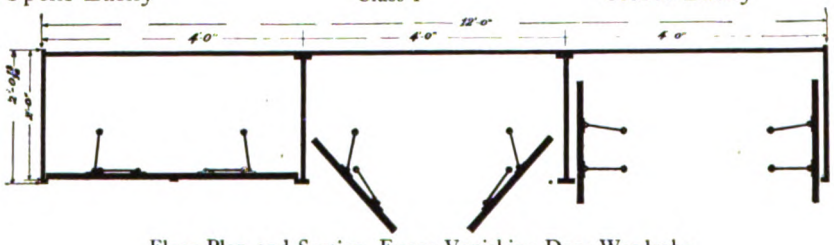
Digitized by Google

Ventilated
Sanitary
Opens Easily

EVANS VANISHING DOOR WARDROBE

Class F

Noiseless
Doors Cannot Stick
Closes Easily



Floor Plan and Section, Evans Vanishing Door Wardrobe

THEY occupy the smallest space possible. When the doors open THEY DO NOT BLOCK THE AISLES nor interfere with the use of the adjoining compartment. In the school room they can be used during class hours, as any little child can operate them and they are absolutely noiseless. ¶ The value of the floor space saved, more than pays for their installation. As an illustration—the school cloak room and additional corridor space requires about one hundred seventy-four square feet—the wardrobes for each room only occupy twenty-four square feet—this makes a saving of one hundred fifty square feet, which would cost to build more than three times the value of the wardrobe. Besides this, when the wardrobes are placed in the school room they are directly under the eye of the teacher, thereby contributing to the morals of the pupils. EVANS VANISHING DOORS *move on double pivoted arms*—no tracks or noisy rollers. ¶ Every piece of work is substantially built and guaranteed. A catalog for the asking.

U. S. TRADE MARK
"VANISHING DOOR"
Registered

PATENTED U. S., CANADA AND FOREIGN COUNTRIES

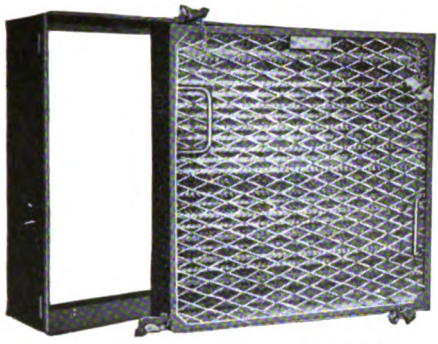
W. L. EVANS

WASHINGTON, INDIANA, U. S. A. **WINDSOR, ONTARIO, CANADA**

See Page 36, Fig. 6, Par. 60

Digitized by Google

Clean Air for the Ventilation of Schools



New Model
Type U2
Cell and Frame

Midwest Air Filters

Principle. Air cleaning by baffling and impinging dust against the sticky surfaces of filter media — a series of specially shaped and perforated metal sheets, coated with Midwest Viscosine, a non-inflammable, non-evaporating viscous fluid. Ample space between filter sheets and large openings in the sheets themselves prevent clogging and building up of resistance.

Installation Operation. The unit is a filter cell and frame as shown. The number of units required for any capacity are assembled in angle iron frames. There are no moving parts and practically no operating supervision is required.

Maintenance. Filter cells are periodically cleaned by washing in hot water and soda in the tank provided for the purpose. They are also recharged with Viscosine in a similar charging tank.

Characteristics. Size of unit (cell and frame): 20″ x 20″ x 6½″. Capacity per unit: 800 cubic feet per minute. Efficiency: Maximum dust content in cleaned air under normal conditions will not exceed 0.05 grains per 1000 cubic feet. Resistance: Maintained at ⅜″ water gauge by routine cleaning. Cleaning: Depends on dust conditions. On average installation each cell is cleaned and charged once every six to eight weeks. Time required per cell about five minutes. Weight of unit (cell and frame): 40 pounds. Viscosine consumption: One gallon per unit per year.

Removing or
replacing cell
in installation

Typical
Midwest
Installation

MIDWEST AIR FILTERS
INCORPORATED
100 EAST 45TH STREET
GRAND CENTRAL TERMINAL BLDG.
NEW YORK, N.Y. U.S.A.
Branches in Principal Cities

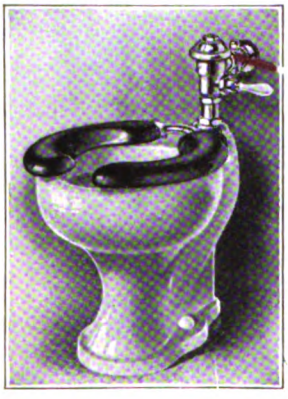
See Page 90, Par. 173

Digitized by Google

SAVE WORRY

BY HAVING YOUR SCHOOLHOUSE
EQUIPPED WITH

ROYAL FLUSH VALVES



THEY DELIVER UNIFORM FLUSH
REGARDLESS OF HOW OPERATED

MANUFACTURED BY

Sloan Valve Company

CHICAGO

MRS. W. C. McQUEENY
Representing
BUFFALO, N.Y. Branch
71 Victoria Ave.

See Page 61, Par. 119

RODDIS DOORS

FLUSH DOORS, as made by Roddis, are now generally recognized as standard equipment for all modern school structures. They are soundproof, sanitary, fire-resisting, of great beauty, with ability to last long and perfectly. They are guaranteed without condition. Your school deserves these better doors. Our special School Booklet shows many interesting installations. It will be mailed upon your request.

RODDIS LUMBER & VENEER COMPANY

Marshfield, Wis.

Branches in all principal cities throughout the world

For a Quarter-Century, the Largest Makers of Flush and French Doors

See Page 41, Par. 76

Digitized by Google

SCHOOL PAINTING GUIDE

For Painting, Varnishing, Staining and Enameling

IMPORTANT: Each of the products specified below bears our name and trade mark

SURFACE	TO PAINT *Use product named below*	TO ENAMEL *Use product named below*	TO STAIN *Use product named below*	TO VARNISH *Use product named below*
BASEMENT WALLS (Interior)	*S-W Eg-Shel Mill White*	*Old Dutch Enamel or Enameloid*		
BRICK WALLS (Exterior)	*S-W Concrete Wall Finish or SWP*	*Old Dutch Enamel, Gloss*		
CEMENT FLOORS	*S-W Concrete Floor Paint*	*S-W Concrete Floor Paint*		
CONCRETE OR STUCCO WALLS	*S-W Concrete Wall Finish*	*Old Dutch Enamel, Gloss*		
DESKS, SEATS and FURNITURE	*Enameloid*	*Enameloid*	*Floorlac* *S-W Handcraft Stain*	*Scar-not Varnish*
EXTERIOR WOOD SURFACES	*SWP* (Sherwin-Williams Prepared Paint)	*Old Dutch Enamel, Gloss*	*S-W Preservative Shingle Stain* *S-W Acid or Oil Stain*	*Rexpar Varnish*
EXTERIOR METAL SURFACES (Fire escapes, etc.)	*Kromik Steel Primer Metalastic* (for finishing coats)	*Old Dutch Enamel, Gloss*		
FLOORS, (Interior wood)	*S-W Inside Floor Paint* (The enamel-like finish)	*S-W Inside Floor Paint* (The enamel-like finish)	*Oil Stain or Floorlac Varnish Stain*	*Floor Seal or Mar-not Varnish*
GALVANIZED IRON SURFACES	*S-W Galvanized Iron Primer* (Finish with any SW Paint)	*S-W Galvanized Iron Primer and Old Dutch Enamel*		
HAND RAILS		*Lustral Enamel*		
INTERIOR WALLS and CEILINGS	*Flat-Tone Wall Finish*	*Old Dutch Enamel or Enameloid*		
INTERIOR WOOD TRIM	*SWP* (Sherwin-Williams Prepared Paint)	*Old Dutch Enamel or Enameloid*	*S-W Acid Stain* *S-W Handcraft Stain* *S-W Oil Stain*	*Scar-not Varnish or (Velvet Finish Varnish* for imitation rubbed effect)
METAL SASH	*S-W Sash Colors*			
RADIATORS and PIPES	*Flat-Tone Paint*	*For White: S-W Snow White Enamel* *For Colors: Enameloid*		
ROOFS, Metal	*SWP or Metalastic* (If galvanized, prime with S-W Galvanized Iron Primer)			
ROOFS, Wood Shingles	*SWP* (Sherwin-Williams Prepared Paint)		*S-W Preservative Shingle Stain*	
STRUCTURAL STEEL	*Kromik Steel Primer Metalistic* (for finishing coats)			
TO DAMP-PROOF FOUNDATIONS	*S-W Antydamp*			
TO HARDEN CEMENT	*S-W Concrete and Cement Hardener* (colorless)			
WOOD PRESERVATION			*S-W Carbolic-ol*	
WOOD FLOOR PRESERVATIVE				*Floor-Seal*

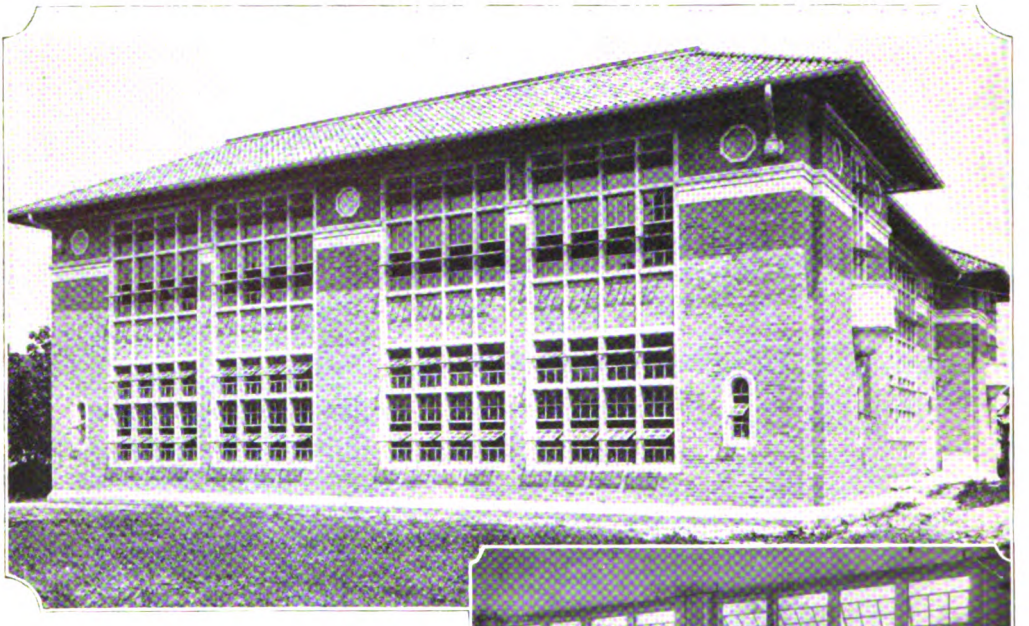
NOTE: *Best results can only be had by following the carefully prepared directions on labels.*

SHERWIN-WILLIAMS PAINTS & VARNISHES

Copyright, 1923, by
The Sherwin-Williams Co.
601 Canal Road, Cleveland, O.

See Page 32, Par. 52

Digitized by Google



Lupton Windows in a Toledo School Building
Cones, Perry & McMullen, Architects

Consider the Windows

They mean much to the child

GOOD natural lighting and fresh air in classrooms are the first requirements of any well planned school building. Much depends on having an abundance of each, as they are essential to the health and welfare of the growing child.

Lupton makes two types of steel windows which are admirably adapted to school use, each of them a quality product. The Projected Type is illustrated here. The Counterweighted Type is the perfect double hung window in steel.

Lupton's experience in providing good light and ventilation in thousands of buildings, and in securing the best results with the greatest economy, is freely placed at your disposal on request.

Don't hesitate to ask for information from our nearest sales office.

Lupton Steel Equipment for Schools

In addition to steel windows, we make other serviceable school equipment. Our pressed steel bench legs, for example, are especially desirable for manual training schools. They are light, strong and fire-retarding.

Then, too, our steel utility cabinets provide safe receptacles for tools, patterns and finished work.

Our steel shelving units are useful for holding stationery and miscellaneous supplies. They are strong and rigid, yet light and easily moved. Write for descriptive circular.

DAVID LUPTON'S SONS COMPANY

MAIN OFFICE AND FACTORY: PHILADELPHIA

Atlanta Boston Buffalo Chicago Cleveland Dallas Detroit Newark Pittsburgh New York Baltimore

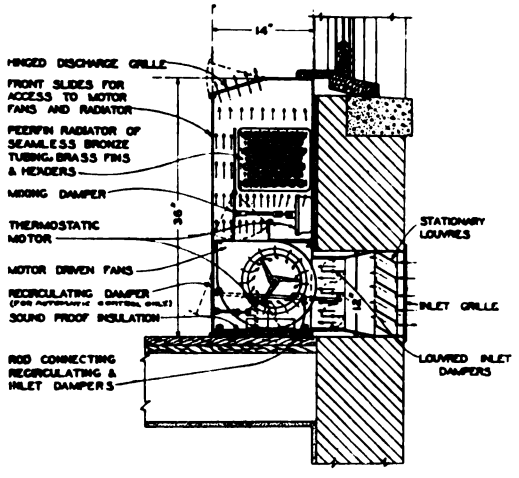
654

See Page 28, Par. 41

Digitized by Google

THE 1925 PeerVent is another triumph of the Peerless Organization. It incorporates all the advantages of the older type Peerless Units and has a number of additional advantages:

The "Peerfin" Radiator, which makes this unit possible, is without doubt the most efficient radiator that has been developed for Ventilating Units. It is compact, has a high efficiency and great durability. It is manufactured in our own factory, subject to rigid inspection and tests.



CROSS-SECTION

MIXING DAMPER UNDER AUTOMATIC CONTROL

Sizes, Capacities, Dimensions and Engineering Data

Unit No.	No. Pupils	C. F. M.	Length	Depth	Height
4726	30	900	33"	14"	36"
4636	40	1200	42"	14"	36"
4645	50	1500	51"	14"	36"

Unit No.	Entering Air, 0 deg. Fahr.		Entering Air, −10 deg. Fahr.	
	Equiv. Rad. Sq. Ft.	Surp. Cap. Sq. Ft.	Equiv. Rad. Sq. Ft.	Surp. Cap. Sq. Ft.
4627	442	172	471	154
4636	590	230	629	206
4645	738	288	776	258

MANUFACTURED BY

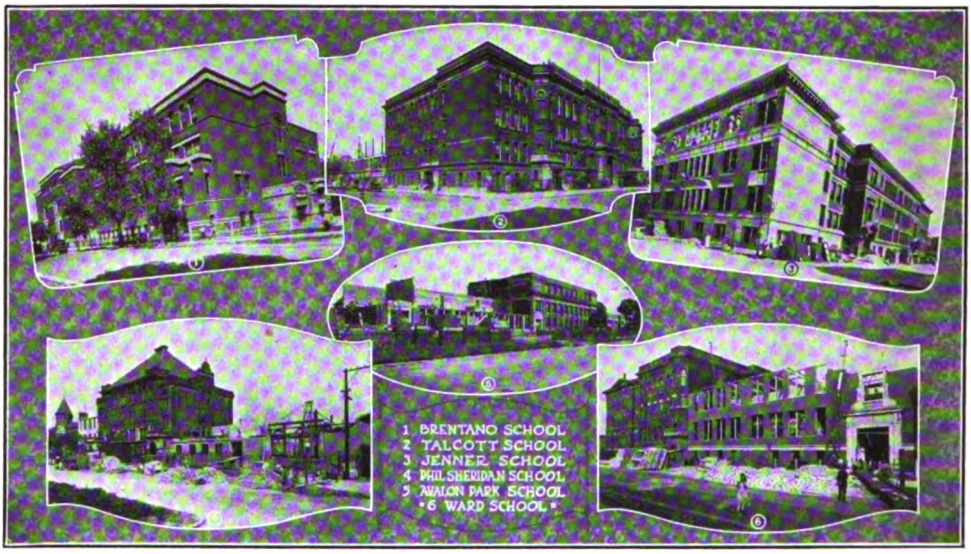
PEERLESS UNIT VENTILATION CO., INC.

SKILLMAN AVE. AND HULST ST. LONG ISLAND CITY, N. Y.

See Page 87, Fig. 6, Par. 166

Digitized by Google

REED AIR IS CLEAN AIR



Six Chicago Schools

being equipped with REED AIR FILTERS

Specifications

Capacity per unit	*800 C. F. M.*
Efficiency (guaranteed)	*97%*
Resistance to Air Flow	*$\frac{3}{16}$"in. Water*
Size overall	*20"x20"x4"*

Our Engineering Dept. will gladly submit data and layouts without cost or obligation. Write for Bulletin No. 108

That Reed Air Filters meet the requirements of clean ventilation in cities like Chicago and Pittsburgh, having unusually dirty atmospheric conditions to contend with, is proof of their high cleaning efficiency.

Low first cost; simplicity of operation; low resistance to air flow; flexibility; ease of installation and high efficiency in the removal of dust, soot and bacteria are some of the advantages of the Reed System.

If you have a ventilation problem requiring clean air, our Engineering Department will gladly furnish complete information without cost or obligation.

REED AIR FILTER COMPANY, Inc.
207 Central Avenue, Louisville, Kentucky
50 Church Street, New York City
Offices in Principal Cities

Reed Air
TRADE MARK
filters ALL METAL

See Page 90, Par. 173

Digitized by Google

Punctuality and Highest Efficiency Secured

Through Installation of

AUTOMATIC PROGRAM CLOCKS

PNEUMATIC MASTER PROGRAM CLOCK

Renders Highest Efficiency at Lowest Maintenance Cost

HAHL PNEUMATIC AND DETROIT ELECTRIC Synchronized Systems

are the

Highest Grade Manufactured
Simplest in Construction
Lowest in Operating Costs
Most Durable

Thousands of users in U. S. and Canada

A Few New York Cities with one or more installations:

Buffalo	Mt. Vernon
Bay Shore	New York
Fredonia	Peekskill
Hartsdale	Rome
Ithaca	Scarsdale
Jamestown	Tarrytown
Mohawk	Utica

ELECTRIC MASTER PROGRAM CLOCK

Send for descriptive matter

Time Systems Company

7755 Grand River Ave.

Detroit, Mich.

BRANCHES

NEW YORK, N. Y.
52 Vanderbilt Ave.

BUFFALO, N. Y.
257 Washington St.

PITTSBURGH, PA. CLEVELAND, O. CINCINNATI, O. CHICAGO, ILL.

See Page 77, Par. 152

Digitized by Google

American Metal Weather Strip Co.

Grand Rapids, Michigan

Makers of

American Windustite All-Metal Weather Strips for all kinds of SCHOOL WINDOWS and Doors

Heavy Channel Type **Metal-to-Metal** Construction, for sliding windows, with Heavy Sill Strip and Side Channels, all applied with screws, making windows easily removable for repairs, without destroying the equipment or damaging the woodwork, and without great loss of time. We also make the most practical and efficient equipment for **Austral Windows,** as well as for **Casement Windows** and **French Doors.** Also Extruded Brass Door Sills for all sizes and styles of doors for schools and public buildings.

Any of our offices in New York State will be pleased to confer with school architects, and furnish details

New York City Branch, 166 Lexington Ave., New York

Sales and Service Offices

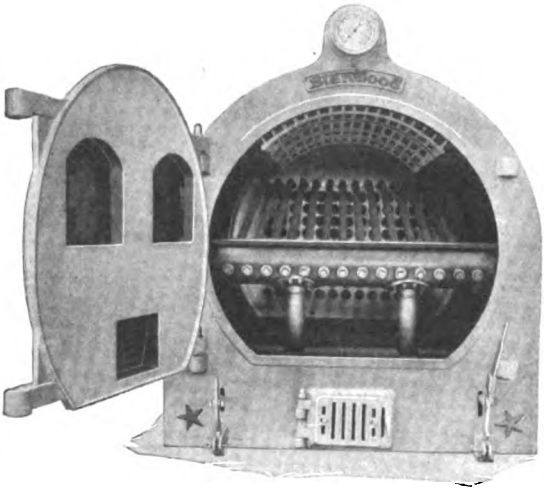
Albany, 86 State Street
Rochester, 72 S. Water Street
Buffalo, 333 Jackson Bldg.
Binghamton, 30 Walnut Street
Elmira, 835 E. 2d Street
Syracuse, 405 Everson Bldg.

See Page 29, Par. 42

FOR ECONOMICAL SCHOOL SERVICE

Stanwood Smokeless Boilers

MADE OF STEEL FOR POWER OR HEATING



Builders since 1891 of Horizontal Return Tubular and Locomotive Fire-Box Portable Boilers. Throttling and Automatic Steam Engines, Open and Closed Feed Water Heaters.

NO MUD LEGS OR STAYBOLTS
LOW WATER LEVEL
RAPID CIRCULATION
LOW STACK TEMPERATURES

The Stanwood Corporation

CINCINNATI, OHIO

SUCCESSOR TO

THE HOUSTON STANWOOD & GAMBLE CO.

Western New York Distributors

LEW SALES AND ENGINEERING CO.

ROCHESTER, N. Y.

See Page 92, Par. 174

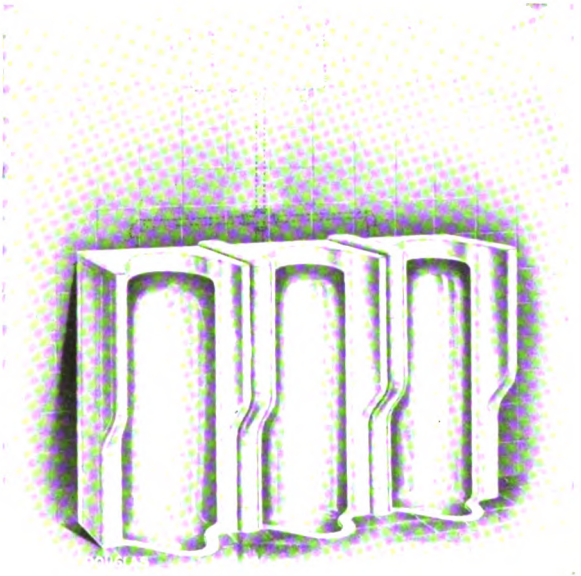
Digitized by Google

Douglas Vitreous China Stall Urinal

YOU would not consider installing a water closet made of any other material than vitreous china — because you know it would be unsanitary. Furthermore, the sanitary laws would prohibit such an installation. Then why should you consider a urinal unless it is made of vitreous china, the same material universally used for the manufacture of water closets and vitreous china lavatories.

The Stall urinal is recognized as the ideal type of urinal for various reasons: It is easily installed, requiring no marble partitions; is the most sanitary and least expensive in cost; once our vitreous china urinal is put in place, it will last as long as the building; always maintains its beautiful white glossy finish and is guaranteed not to craze, crack or discolor.

It required years of experimenting to properly develop and produce such a large piece of vitreous china so that it could be sold commercially, and it is pronounced by leading architects and sanitary engineers as a product that fulfills their ideas for perfect sanitation in the urinal field.



SPECIFICATIONS

Plate H4500 Douglas Vitreous China Stall urinal, 18" wide with integral drip receptor and projecting side shields; glazed white over all exposed parts; vitreous china seam covers; H4885 Douglas China automatic urinal tank behind partition with cast brass angles; H4902 branching flush pipe behind partition; H4926 cast brass inlet connection and adjustable spreader; H4951 cast brass outlet connection, for lead or iron pipe, with sanitary raised removable outlet cover.

THE JOHN DOUGLAS COMPANY

CINCINNATI, OHIO

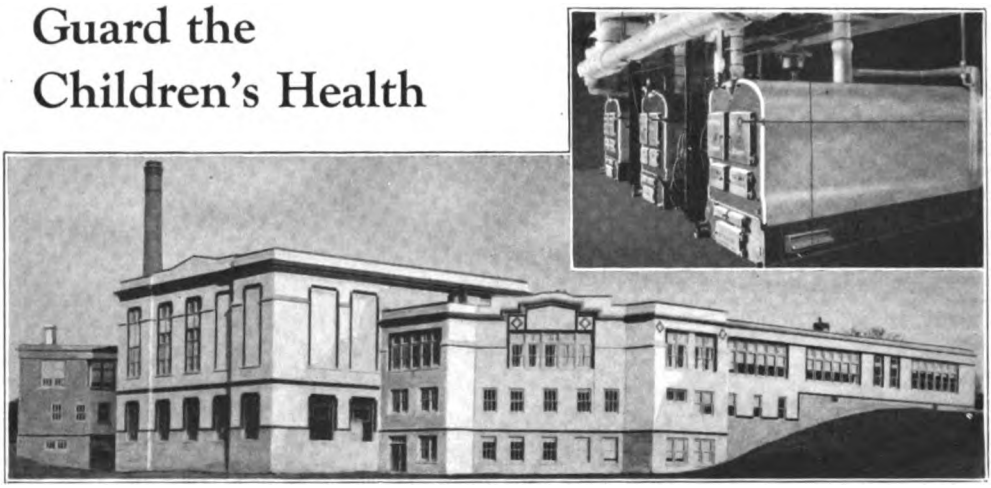
Manufacturers of School Plumbing Fixtures

See Page 61, Par. 122

Digitized by Google

INTERNATIONAL HEATERS

Guard the Children's Health



UTICA COUNTRY DAY SCHOOL

DOWN in the boiler room of the Utica Country Day School—is the heating plant which supplies warmth so vital to the health of children.

In this school, as in hundreds of others, INTERNATIONAL Economy Boilers are relied upon to maintain an even, comfortable temperature inside regardless of weather conditions. This performance is not unusual—it is a dependable safeguard of the health of children for whom you are building schools.

Whether the modern school is a one-room affair or a very large structure—there's an INTERNATIONAL Heater for the building.

And every INTERNATIONAL Boiler or Furnace may be tended easily: special janitor attention is not a necessity, a feature which appeals favorably to those who supervise municipal schools.

We shall be glad to serve you. Our engineers are capable men, interested in your heating engineering problems and ready to solve them without cost to contractors or construction men. Further information and expert advice is constantly available at our general office or any of the INTERNATIONAL branches.

International Heater Company

UTICA, N. Y.

Branches and Warehouses

NEW YORK CHICAGO CLEVELAND DETROIT NASHUA, N. H.

See Page 80, Par. 157-174

Digitized by Google

For the protection and decoration of exterior and interior surfaces

ROWE'S PAINTS

represent the highest standard of perfection in the art of

Good Paint Making

Standard Products are:

Lead and Zinc Analyzed Brand House Paint, Washable Flat Wall Finishes, Interior White Enamel, Exterior Concrete and Brick Paints, Porch and Deck Paints, Shingle Stains, Metal Protective Paints, Asphalt-Asbestos Roof Coatings, Varnishes and Fillers.

MADE BY

Rowe Paint & Varnish Co., Inc.

MAKERS OF PAINTS FOR EVERY SURFACE

NIAGARA FALLS, N.Y., U. S. A.

Rowe's Paints have been approved and adopted by the Board of **Education** *of* **Niagara Falls**, *N. Y.*

See Page 32, Par. 52

WHEN PLANNING SCHOOLS REMEMBER

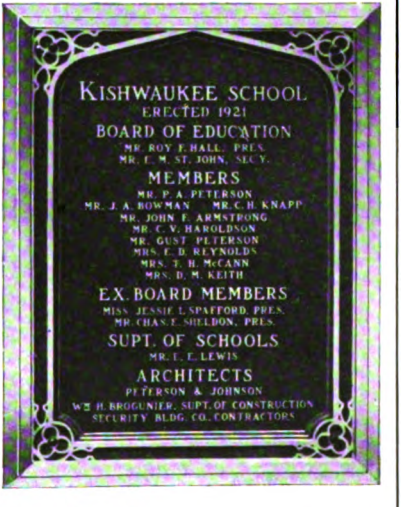
NEWMAN BRONZE TABLETS

No school is really complete without an everlastingly beautiful Cast Bronze Tablet, listing the names of the board members, the contractors and the architect.

And no tablets are better in every way (or lower in price) than Newman guaranteed bronze tablets. That's why they are the choice of leading schools and school architects in the United States.

It will be a genuine pleasure to submit suggestive designs and our best prices to those interested in permanently marking schools.

No obligations involved.



CHALK TROUGHS—METAL DOORS—FLAG POLES
DOOR HARDWARE—THRESHOLDS—RAILINGS—BRASS POOL LADDERS

Send for catalogs, suggestions and lowest prices.

THE NEWMAN MFG. CO.

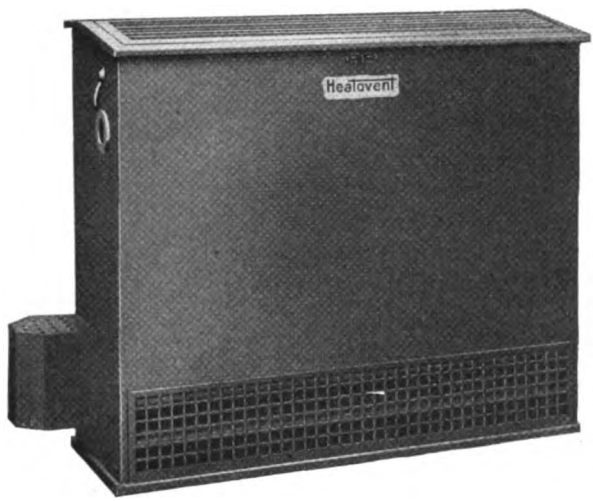
416-418 Elm St. Cincinnati, Ohio

Digitized by Google

Heatovent

(REG · U·S·PAT · OFF·)

The Economical Method of Class-Room Ventilation



A VENTILATING UNIT FOR EVERY ROOM

SIMPLE IN OPERATION—A central fan system will require twice as much electric power.

EFFECTIVE—Diffuses the air perfectly to the far corners of the room.

ECONOMICAL—A properly-designed unit system, eliminates heat flues and central-fan apparatus rooms, thus saving in building construction.

A room need not be ventilated except when occupied. You do not put all the lights in the building on one switch—then why all the ventilation on one fan?

VENTILATE THE MODERN WAY

Our nearest district office will gladly co-operate in planning a Unit Layout

BUCKEYE BLOWER COMPANY

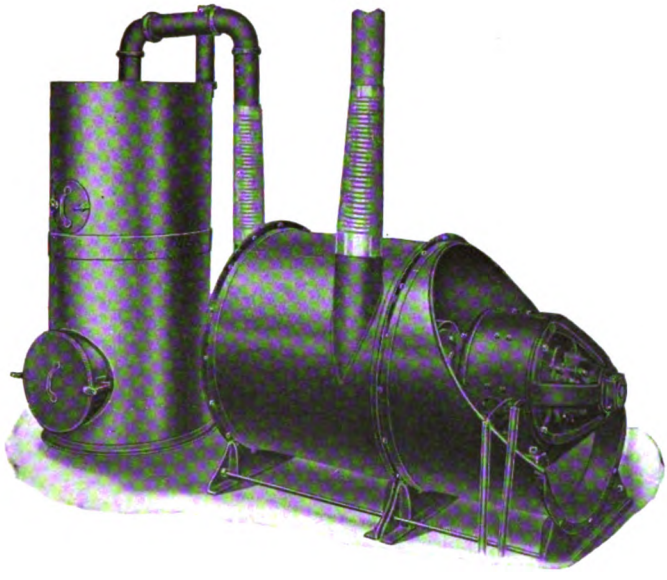
COLUMBUS, OHIO

NEW YORK OFFICES

333 JACKSON BUILDING, BUFFALO :: 1400 BROADWAY, NEW YORK

See Page 87, Par. 166

Digitized by Google



Spencer Vacuum Cleaning Systems

are found in the finest school buildings throughout the United States and Canada. Hundreds of repeat orders testify to satisfactory and efficient service.

Write for list of references of school installations and complete data regarding Spencer equipment.

THE SPENCER TURBINE COMPANY
HARTFORD, CONNECTICUT.

Digitized by Google

Safety-Lock Pressed Steel Stairs

Have proved through many years of actual use in all types of school buildings that they are particularly well adapted for that purpose.

They are very neat and attractive in appearance and simple in design, so that they can easily be adapted to any requirements of the architect and builder, and to any design—from the most simple to the most highly ornamental.

While comparatively light in weight, they are very strong and practically free from vibration under loading stress.

Easily and quickly installed at low cost.

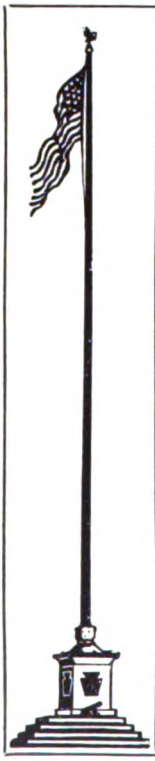
Let us send you full information regarding construction of these stairs and typical installations in your vicinity. Estimates furnished upon request.

Manufactured by

THE HUGHES-KEENAN COMPANY

MANSFIELD, OHIO

See Page 42, Par. 82



Steel Flag Poles

Our *Exclusive* Product

Better by 22 years' Experience

Proved by over 20,000 in service as

Ground Set, Roof Set or as Window Poles

Accepted as standard by

N. Y. Board of Education
N. Y. State Board of Armorers
U. S. Treasury Dept. of Buildings
U. S. P. O. Dept., etc.

The Pole & Tube Wks.
INCORPORATED

NEWARK, N. J.

Ask us FIRST—then specify

See Page 100, Par. 186

Carey

ASBESTOS-ASPHALT ROOFING

"A Roof for Every Building"

THE CAREY COMPANY

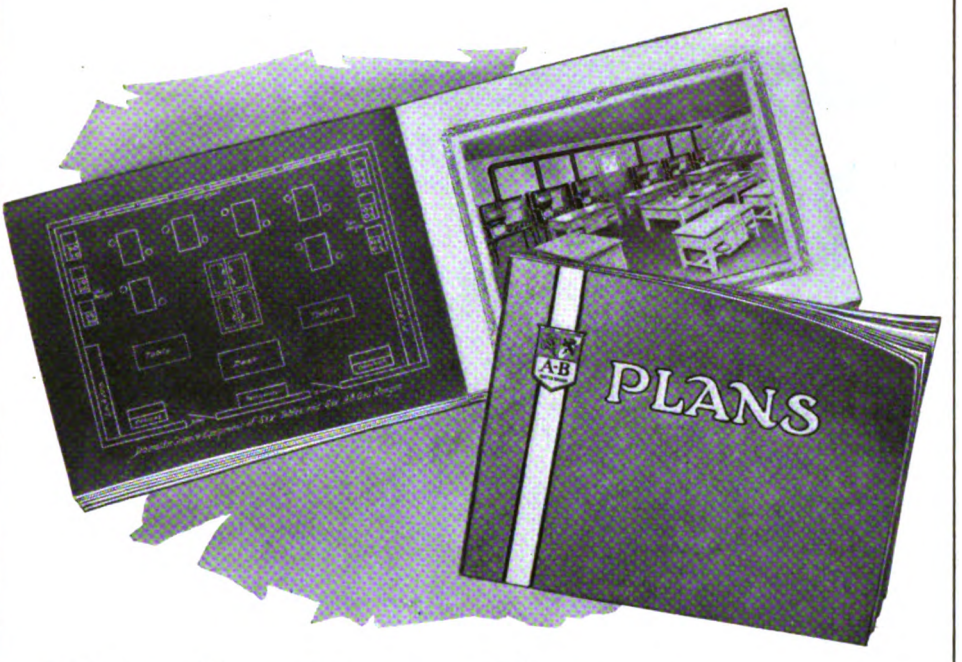
1174 NIAGARA ST., BUFFALO

BRANCHES

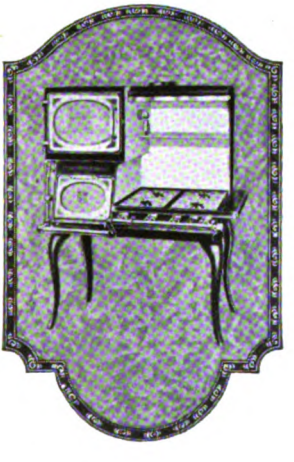
Niagara Falls, Rochester, Jamestown, Elmira, Batavia, Geneva

See Page 34, Par. 54

Digitized by Google



Visualize Your Classrooms
Before You Equip Them



When your school is planned and the classroom plans have been completed in all their details, are you sure that nothing has been overlooked? Have you visualized just how they are going to be after they are equipped?

Arrangement and equipment can make or mar the efficiency of domestic science classroom training.

School superintendents, directors and authorities charged with the planning and equipping of institutions of learning will find much that will be of interest and value in PLANS — a complete, authentic and up-to-date book on the planning and equipping of domestic science classrooms. It contains blue prints of model classrooms, shows photographs of actual classroom installations and provides other information desirable in a practical reference work.

We will gladly send a copy of PLANS to anyone interested, upon request. No cost or obligation. Send for your copy today.

A-B STOVE COMPANY BATTLE CREEK Mich.

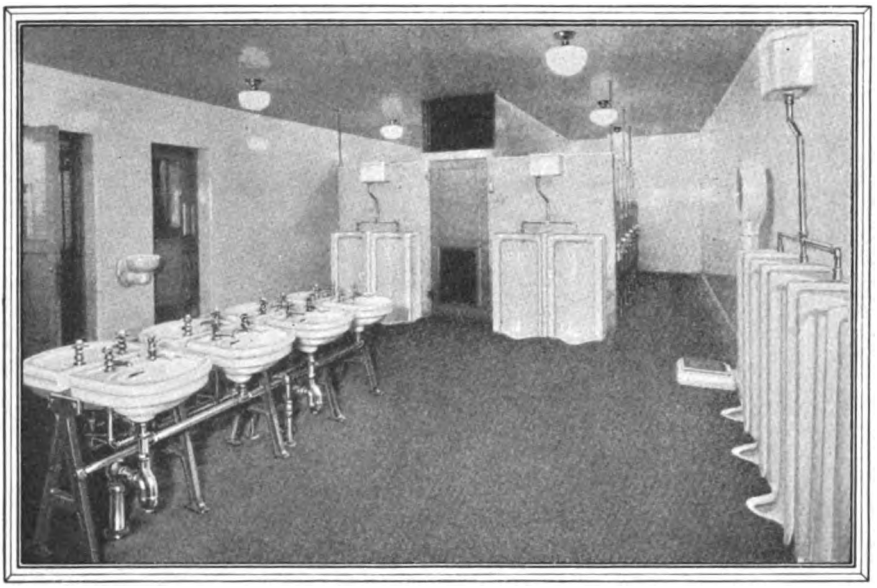
World's Largest Exclusive Manufacturers of Gas Ranges

A-B Gas Ranges

"Recognized Everywhere As America's Best"

See Page 54, Par. 105

Digitized by Google



WHY SCHOOLS DEPEND ON CRANE PLUMBING

In hundreds of public and private schools, Crane sanitary fixtures and fittings are used exclusively. When new buildings are planned, the reasons for this preference become important.

Clean, dependable service comes first. All Crane fixtures are designed for durability. There are no sharp corners to break off, no crevices or pockets to offer lodgment to dirt or grime. Rough usage does not affect their sturdy strength. Their simple, substantial beauty breeds respect even in careless youth.

Faucets, valves, piping and fittings are of correct proportions and design. Waste will not clog them and interrupt service. The wide variety of styles brings them within any building budget. Crane fixtures, valves, fittings and piping are sold through established contractors everywhere.

CRANE

CRANE CO., 201 CHURCH STREET, BUFFALO

GENERAL OFFICES: CRANE BUILDING, 836 S. MICHIGAN AVE., CHICAGO

Branches and Sales Offices in One Hundred and Forty-eight Cities

National Exhibit Rooms: Chicago, New York, Atlantic City, San Francisco and Montreal

Works: Chicago, Bridgeport, Birmingham, Chattanooga, Trenton and Montreal

CRANE EXPORT CORPORATION: NEW YORK, SAN FRANCISCO, SHANGHAI

CRANE LIMITED: CRANE BUILDING, 386 BEAVER HALL SQUARE, MONTREAL

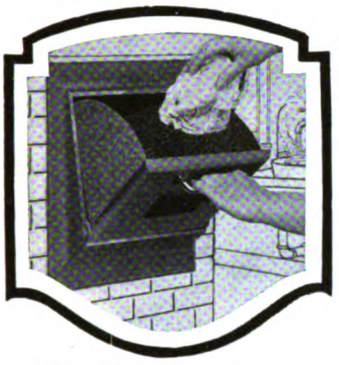
CRANE-BENNETT, LTD., LONDON

CIE CRANE: PARIS, NANTES, BRUSSELS

Crane Drainage Fitting

See Page 61, Par. 119

Digitized by Google



A *Permanent* Health, Economy and Convenience Asset — No Upkeep

The Kernerator system of instant waste disposal — without fuel of any kind — is a sanitary convenience which scores of schools would not think of being without.

Into the handy hopper doors *all* waste—remnants of lunches, papers, sweepings, garbage from the cafeteria, tin cans, broken glassware — is dropped and then forgotten.

The Kernerator consists of a brick combustion chamber built at the base of the chimney in the basement with hopper doors on the floors above. The waste falls to the combustion chamber where an occasional lighting consumes everything burnable. Non-combustibles, flame-sterilized, are removed with the ashes.

The Kernerator must be built in when the building is being erected — it cannot be installed later. Consult your architect or write

KERNER INCINERATOR CO.
1071 CHESTNUT ST. MILWAUKEE, WIS.

A Few School Installations:

Central High
Tulsa, Okla.
Washburn College
Topeka, Kans.
East Side High
Green Bay, Wis.
Frederick High
Frederick, Md.
Nathan Hale School
New Haven, Conn.
Shreveport High
Shreveport, La.

KERNERATOR
Built-in-the-Chimney
Reg. U. S. Patent Office

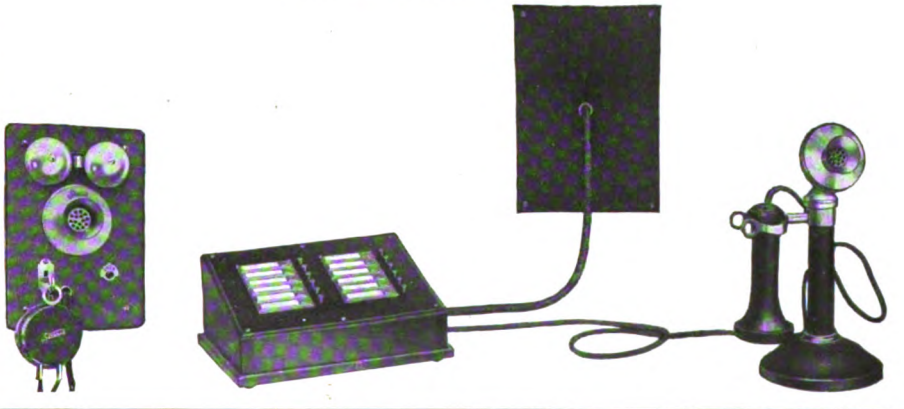
See Page 62, Par. 125

SAMSON ELECTRIC CO.

SPECIALISTS IN

Telephone and Fire Alarm Systems for Schoolhouses

WM. N. PIERCE, NEW YORK STATE REPRESENTATIVE
257 Washington Street, Buffalo, N. Y.



See Page 78, Par. 154

Digitized by Google

He Who Followed
A Star
BY JAMES WALLEN

THOMAS BIRD MOSHER was the prince of publishers, not by measure of the large output of his presses, but by virtue of its jeweled quality.

¶ I do not think that Mosher ever issued an unworthy book, as to text or typography. And yet he was a starlighted success.

¶ One of my clients, McDougall-Butler, have set themselves a task in the making of paints, varnishes and enamels very near the Mosher idea.

¶ McDougall-Butler aspire not to enormous volume, but to undisputed leadership in quality.

¶ The noble architecture of some of America's finest school buildings is enhanced by McDougall-Butler paints, varnishes and enamels.

McDougall-Butler Co. Inc.
MAKERS OF
Varnishes, Enamels and Paints
Evans, Water & Norton Streets
Buffalo, N. Y.

McDougall-Butler Varnishes, Enamels and Paints are described on page 1544, Sweet's Catalog.

See Page 32, Par. 52

FERALUN
Anti-Slip Treads

Falls are not Jokes

In just that part of New York City called Manhattan 1,456 people in the past eight years have been *killed* by falls on stairs and slippery floors—*more* than from fires, surface cars and elevators combined.

PUBLIC Schools especially should not have the old-fashioned slippery steel or brass door saddle, stair tread trench cover, etc., in this era of Accident Prevention.

The same metals in the usual shapes but with abrasive grit in the wearing surface to resist wear and to prevent slipping are obtainable as FERALUN, BRONZALUN and ALUMALUN, the adopted standards for important school buildings.

American Abrasive Metals Co.
50 Church Street **New York City**

See Page 43, Par. 84

HEATING AND VENTILATING

MODERN Schoolhouses demand that the most modern and economical type of Heating and Ventilating Systems shall be installed.

To accomplish this, one must have a thoroughly technical and practical knowledge of the heating and ventilating profession, as applied to the more modern type of our better buildings.

After this knowledge has been obtained, the system that will attain the desired results, in the most efficient and economical way, is the best to install.

Years of practical experience and technical knowledge has placed us in a position to offer you the best of services in this particular branch of Engineering.

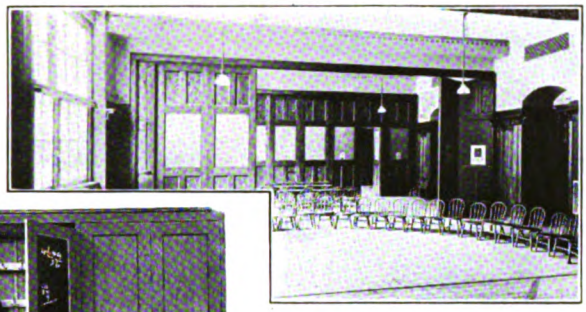
Strong & Byron
Heating Engineers
and Contractors
350 Third Street :: Niagara Falls, N. Y.
Write for further particulars
Phone 2186-R

See Page 80, Par. 156

Digitized by Google

WILSON

Necessities for Every School Building



Sectionfold and Rolling Partitions

Send for Catalogue No. 37

Hygienic Wardrobes

Disappearing Door and Rolling Front Types

THE J. G. WILSON CORPORATION 11 EAST 36TH ST., NEW YORK CITY

See Page 36, Par. 60

USG

In School Buildings Everywhere

A list of buildings in which U S G Plaster Products have been used reads like a school directory of the nation. U S G materials are widely known for their superior fire-resisting and insulating qualities. Their permanency, decorative possibilities and minimum upkeep expense are just as satisfactory.

Gypsum Plaster
in red top bags

U S G Plaster is standard for interior walls and ceilings. It is a plaster that works easier and spreads farther, and is of exceptional tensile strength. Identify it by the red top on the bag. There are U S G Plasters for finishing—gauging—moulding—and various other uses.

USG SHEETROCK
The FIREPROOF WALLBOARD

Ideal for permanent walls and ceilings in new construction. Economical for alterations and remodeling. Large, sturdy, factory-cast sheets of gypsum—3/8-inch thick; sawed and nailed like lumber. Resists fire and weather—won't warp or shrink. Paper, paint, calcimine—or decorate with Textone for unusual effects.

UNITED STATES GYPSUM COMPANY

205 West Monroe Street :: Chicago, Illinois

Mills at Oakfield and New Brighton, New York

Digitized by Google

Attractive Country Schoolhouses

Weatherbest Stained-Shingles

A WIDE range of colors, and many styles in which they can be laid, make WEATHERBEST Stained Shingles ideal for roof and sidewalls of the one- or two-room country schoolhouse. The same color scheme can be carried out on the teachers' cottage. WEATHERBEST Stained Shingle sidewalls cost only one-half as much as clapboard sidewalls and last as long as the building.

Send for literature and color samples

WEATHERBEST
Stained Shingle Co.
Incorporated
North Tonawanda, N. Y.
Western Plant
Minnesota Transfer, Minn.

This schoolhouse is covered with Brown WEATHERBEST Stained Shingles. As WEATHERBEST are all vertical grain and preserved in creosote, they lie perfectly flat, without warping or curling, during their many years of service.

UNION FIBRE CO., *Inc.*

WINONA, MINN.

LINOFELT
An Insulating Quilt

FIBROFELT
An Insulating Panel

ACOUSTICAL FELTS AND BOARDS

Engineering Advice furnished on request

M. J. TIERNEY COMPANY

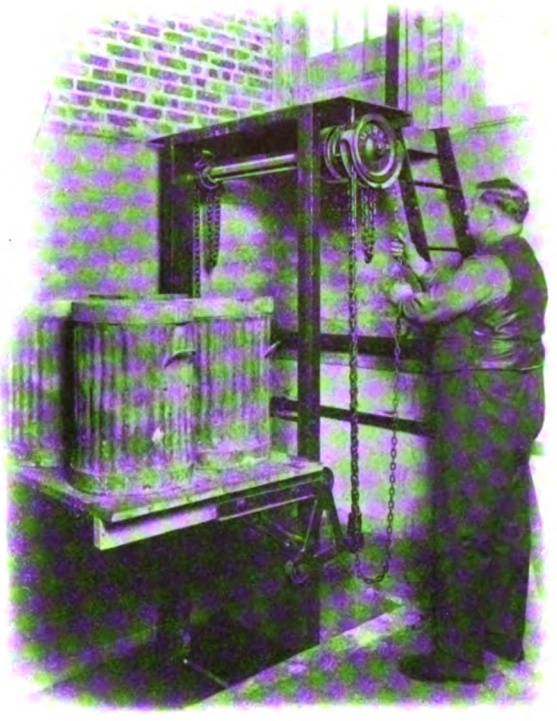
NEW YORK STATE AGENTS

CUTLER BLDG.
ROCHESTER

41 ANDREWS BLDG.
BUFFALO

See Page 39, Par. 67

Digitized by Google



WHEREVER the heating plant is below grade level, some means of removing ashes should be provided.

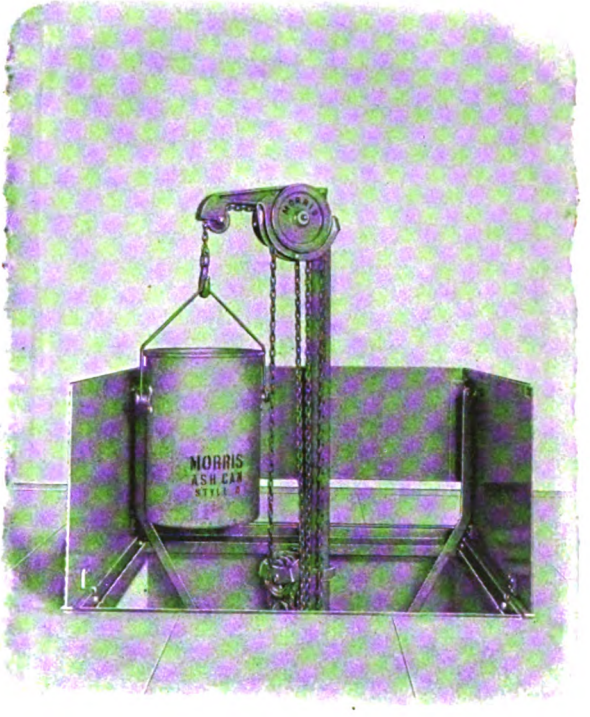
Three Morris ash hoists are here shown: the *mast type* to raise cans to a window, the *platform type* handling four cans at a time, and the *disappearing type* complete with automatic doors and guard gates.

All types have automatic brakes, ball- or roller-bearings and carry the load on *heavy steel chains. No wire rope used. No cranks to turn.*

Morris ash hoists are standard equipment in schools all over the country. The Montreal Board of Education writes, " — giving us splendid service under very trying conditions. As far as possible we shall always endeavor to use your equipment and see that same is specified."

Ask for Book 73 describing all models, also cans, areaway doors, etc.

Herbert Morris Incorporated
Buffalo, N. Y.

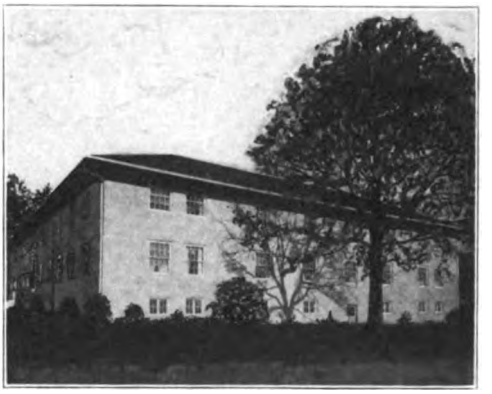


Digitized by Google

For School Construction

Bishopric Walls make permanent, economical, beautiful Structures

Leading Architects and Builders recommend Bishopric Stucco over Bisphoric Base for permanent, economical construction. Bishopric Stucco is locked firmly to the wall by Bishopric Base.



Girls Dormitory—Miami University, Oxford, O.
Bishopric on all exteriors

Bisphopric Stucco comes in a variety of attractive shades, can be finished in any texture, and is permanent, with no cost of upkeep.

The cost is no more than that of good frame construction.

Bishopric is specified and recommended by Messrs. White & LaChance, Architects.

Write for further information—there is no obligation.

THE BISHOPRIC MANUFACTURING CO.
2000 ESTE AVENUE :: CINCINNATI, OHIO

See Page 70, Par. 142

R. S. McMannus Steel Construction Company, Inc.

ENGINEERS
DESIGNERS
FABRICATORS
and ERECTORS
of
STRUCTURAL STEEL

1238-1254 E. Ferry Street
Buffalo, N. Y.

See Page 70, Par. 142

Industrial Planning Corporation

Consulting Engineers

Specialists in the design and layout of Heating, Ventilating and other mechanical equipment for schools :: ::

EXAMINATIONS
REPORTS
RECOMMENDATIONS

80 WEST GENESEE STREET
BUFFALO, N. Y.

See Page 80, Par. 156

Digitized by Google

EDUCATORS everywhere have asked this question:

"Why should a school use motion pictures?"

MODERN schools cannot afford to be without up-to-date equipment and apparatus for presenting facts, because many of the facts of science and experience are presentable *by means of motion pictures only.*

MOTION picture equipment and apparatus should be a part of the equipment of every school department.

THE motion picture affords one of the most fruitful sources of harmless enjoyment for school children. All children should be trained in the school to appreciate and select good motion pictures for enjoyment. ¶ The motion picture is an excellent source of revenue to the school for raising funds for extra-curricular activities.

THE motion picture *can instruct* and has proven its value for such purposes when properly used.

MOTION pictures can be used in an effective way by the school for propaganda concerning its own problems. That is, the school can make its own safety film, health film, sanitation film, and use it successfully in such campaigns.

Motion Picture Projectors

Delineascopes
Stereopticons
Balopticons
Screens
Accessories

Scientific Films
Geographic Films
Travelogues
Classic Subjects

Our ten years' experience in the Educational Field assures you the correct equipment for your needs

LITERATURE ON REQUEST

United Projector & Film Corp.

228 Franklin Street . . . Buffalo, New York

51-53 CHAPEL STREET
ALBANY, N. Y.

1111 KEENAN BUILDING
PITTSBURGH, PA.

See Page 75, Par. 151

Digitized by Google

Digitized by Google

INDEX TO ADVERTISEMENTS

Name	Page
A-B Stove Co.	191
American Abrasive Metals Co.	194
American Metal Weather Strip Co.	184
Bishopric Mfg. Co.	198
Bradley Washfountain Co.	168
Buckeye Blower Co.	188
Carey Co., Philip	190
Clarage Fan Co.	169
Continental Heater Corporation	155
Crane Co.	192
Dahlstrom Metallic Door Co.	171
Douglas Co., The John	185
Dudfield Mfg. Co.	163
Empire Builders' Supply Co.	168
Empire Stucco Co.	165
Evans, W. L.	176
Hirschman Co., Inc., W. F.	160
Holtzer-Cabot Electric Co.	168
Hughes-Keenan Co., The	190
Industrial Planning Corporation	198
International Heater Co.	186
Italian Mosaic and Marble Co., Inc.	172
Johnson Service Company	165
Kerner Incinerator Co.	193
Lupton Sons & Co., David	180
McDougall-Butler Co., Inc.	194
McMannus, R. S., Steel Const. Co.	198
Morris, Herbert, Inc.	197
Midwest Air Filters, Inc.	177
Newman Mfg. Co.	187
"Norristone"	174
Ohio Quarries Co., The	161
Peerless Unit Ventilation Co., Inc.	181
Pierce, W. N.	193
Pole and Tube Works, Inc., The	190
Reed Air Filter Co., Inc.	182
Richards-Wilcox Mfg. Co.	156
Richardson & Boynton Co.	166–167
Roddis Lumber and Veneer Co.	178
Rowe Paint and Varnish Co., Inc.	187
Samson Electric Co.	193
Sherwin-Williams Co., The	179
Sloan Valve Co.	178
Spalding & Bros., A. G.	157
Spencer Turbine Co., The	189
Standard Conveyor Co.	164
Standard Electric Time Co.	173
Stanwood Corporation, The	184
Strong & Byron	194
Sturtevant Co., B. F.	175
Taylor Co., Halsey, The	163
Tierney Co., M. J.	196
Time Systems Co.	183
Trane Co., The	162
Truscon Steel Co.	170
United Projector & Film Corp.	199
United States Gypsum Co.	195
Vonnegut Hardware Co.	174
Walbridge & Co.	158
Weatherbest Stained Shingle Co.	196
Westinghouse Electric and Mfg. Co.	159
Wilson Corporation, The J. G.	195

Digitized by Google

INDEX TO ADVERTISEMENT REFERENCES

Name	Subject	Page	Fig.	Par.
A-B Stove Co.	Ranges	54		105
American Abrasive Metals Co.	Non-Slip Treads	55		106
American Metal Weather Strip Co.	Weatherstripping	29	7	42
Bishopric Mfg. Co.	Stucco, Insulating Base	70		142
Bradley Washfountain Co.	Washfountains	59		116
Buckeye Blower Co.	Unit Heating	87	6	166
Carey Co., Philip	Roofings	34		54
Clarage Fan Co.	Fans	86		165
Continental Heater Corporation	Boilers	91		174
Crane Co.	Plumbing Fixtures	61		119
Dahlstrom Metallic Door Co.	Metallic Doors	41		77
Douglas Co., The John	Plumbing Fixtures	61		119
Dudfield Mfg. Co.	Chalk Troughs, Metal	31	9	50
Empire Builders' Supply Co.	Hollow Tile	70		142
Empire Stucco Co.	Stucco	70		142
Evans, W. L.	Wardrobes	36	6	60
Hirschman Co., Inc., The W. F.	Roof Ventilators	89		171
Holtzer-Cabot Electric Co.	Signal Systems	72		144
Hughes-Keenan Co., The	Steel Stairs	42		82
Industrial Planning Corporation	Engineering Services	80		156
International Heater Co.	Boilers	91		174
Italian Mosaic and Marble Co., Inc.	Marble and Terrazo Work	40		115
Johnson Service Co.	Temperature Control	89		172
Kerner Incinerator Co.	Incinerators	62		125
Lupton's Sons Co., David	Steel Windows	28		41
McDougall-Butler Co., Inc.	Painting and Decorating	32		52
McManus, R. S., Steel Const. Co.	Industrial Steel	70		142
Midwest Air Filters, Inc.	Air Filters	90		173
Morris, Herbert, Inc.	Ash Hoists	00		00
Newman Mfg. Co.	Bronze Tablets	00		00
"Norristone"	Cut-Cast Granite	00		00

Digitized by Google

INDEX TO ADVERTISEMENT REFERENCES

Name	Subject	Page	Fig.	Par.
Ohio Quarries Co., The	Ohio Sandstone	00		00
Peerless Unit Ventilating Co., Inc.	Unit Heating	87	6	166
Pierce, W. N.	Signal Systems	72		144
Pole and Tube Works, Inc., The	Flagpoles	100		186
Reed Air Filter, Inc., The	Air Filters	90		173
Richards-Wilcox Mfg. Co.	Folding Door Hardware	73		147
Richardson & Boynton Co.	Boilers and Furnaces	91		174
Roddis Lumber and Veneer Co.	Veneered Doors	41		76
Rowe Paint and Varnish Co., Inc., The	Painting and Decorating	32		52
Samson Electric Company	Signal Systems	72		144
Sherwin-Williams Co.	Painting and Decorating	32		52
Sloan Valve Co.	Flush Valves	61		119
Spalding & Bros., A. G.	Gymnasium Equipment	56		107
Spencer Turbine Co., The	Vacuum Cleaning	00		00
Standard Conveyor Co.	Spiral Fire Escapes	43		86
Standard Electric Time Co.	Clock Systems	77		152
Stanwood Corporation, The	Boilers	91		174
Strong & Byron	Heating Engineers	80		156
Sturtevant Co., B. F.	Blast Systems and Air Washers	00		00
Taylor Co., The Halsey	Drinking Fountains	61		120
Tierney Co., M. J.	Floor Deadening	39		67
Time Systems Co.	Clock Systems	77		152
Trane Co., The	Vacuum Heating Systems	82		159
Truscon Steel Co.	Steel Windows	28		41
United Projector & Film Corp.	Motion Pictures	75		151
United States Gypsum Co.	Gypsum Plaster and Sheetrock	00		00
Vonnegut Hardware Co.	Panic Bolts and Hardware	42		81
Walbridge & Co.	Finishing Hardware	42		80
Weatherbest Stained Shingle Co.	Stained Shingles	00		00
Westinghouse Electric and Mfg. Co.	Electrical Equipment	79		155
Wilson Corporation, The J. G.	Wardrobes and Folding Doors	36	6	60

Digitized by Google

INDEX TO TEXT REFERENCES

Subject	Page	Paragraph
Acoustics	46	96
Agriculture Equipment	73	147
Agriculture Laboratory	73	147
Agriculture, Rooms Required	72	146
Agriculture, Scientific	96	181
Agriculture Shop	74	148
Agriculture, State Aid	75	150
Agriculture, Vocational	72	145
Air Channels	89	169
Air, Fresh, Amount Required	10	(J)
Air Filters	90	173
Air, Ground	13	4
Air Test	85	162
Architect, Selecting of	5	...
Aspect	14	5
Aspect, North and North West	14	7
Aspect, East and South East	14	9
Aspect, North and East	14	10
Aspect, West and South West	14	8
Assembly Room, Advantages of	44	91
Assembly Room	47	98
Assembly Room, Location of	45	92
Assembly Room, Seating	45	93
Bacteria at Work	65	130
Balustrade, Closed	43	83
Basement	15	12
Basement Damp Course	16	14
Basement Drainage	15	13
Beamed Ceilings, Exposed	27	32
Bilateral Lighting of Class Rooms	23	26
Bilateral Lighting, Objections to	24	27
Blackboards	29	43
Blackboards, Color of	30	48
Blackboards, Composition	29	45
Blackboards, Chalk Troughs	31	50
Blackboards, Glass	30	46
Blackboards, Height of	30	49
Blackboards, Liquid Slate	29	44
Blackboards, Wood-Fibre	29	45
Boilers	91	174
Boilers, Cast Iron Sectional	91	174
Boilers, Fire-Box	92	174
Boilers, Water-Tube	92	174
Breeze Windows	23	25
Chalk Troughs	31	50
Corridors	37	65
Cost Items, School Buildings	12	(T)
Cost Units	11	(S)
Class Rooms, Elementary	19	15
Class Room Heights	22	20
Class Rooms in High Schools	46	97
Clock Systems	77	152
Coat Rooms	36	60
Consolidated Schools	94	176
Consolidated School Center	95	178
Consolidated School Campaign	98	185
Consolidated School, Community Spirit	97	182
Consolidated School Districts	98	184
Consolidated Schools, History of	94	176
Consolidated Schools, Local Conditions	98	183
Consolidated Schools, Rural Life	94	177
Consolidated School Structure	95	179
Community Spirit	97	182

Digitized by Google

INDEX TO TEXT REFERENCES

Subject	Page	Paragraph
Damp Course	16	14
Desks, Size of	23	21
Desks, Spacing of	22	19
Disposal Field, Sewage	68	136
Drainage, Basement	15	13
Drainage, Sewage	68	136
Doors, Veneered	41	76
Doors, Metal	41	77
Doors, Size of	41	78
Doors, Outside	42	81
Drinking Cups	70	141
Drinking Fountains	61	120
Elementary Class Rooms	19	15
Engineers, Employment of	80	156
Exhibition Boards	32	51
Fans, Mechanically Driven	88	168
Fans, Ventilating	88	167
Fire Alarm System	72	144
Fire Escapes	43	86
Fire Escapes, Spiral	43	86
Fire Losses	71	142
Fireproofing	71	142
Floors	38	66
Floors, Asphalt Mastic	40	74
Floors, Composition	40	73
Floors, Concrete	15	13
Floors, Corridor	40	72
Floors, Deadening	39	67
Floors, Doubled	9	68
Floors, Finishing	40	71
Floors, Gymnasium	57	111
Floors, Hardwood	39	69
Floors, Laying of	40	70
Floors, Linoleum	40	75
Floors, Sanitary	59	117
Floor Space, Minimum	19	16
Flag	100	186
Gradients	44	89
Gravity Ventilation	85	163
Ground Air	13	4
Grounds, Improvement of	8	...
Grounds, Play	15	2
Grounds, Size of	13	2
Gymnasium	56	107
Gymnasium Equipment	56	108
Gymnasium Floors	57	111
Gymnasium Locker Rooms	58	114
Gymnasium, Size of	56	109
Gymnasium, Storage Space	57	112
Gymnasium Wall Boards	57	110
Hardware, Finishing	42	80
Heating and Ventilation	79	155
Heating, Combination	82	158
Heating, Direct-Indirect	86	164
Heating, Hot Blast	86	165
Heating, Hot Water	84	161
Heating, Steam	88	160
Heating Systems	80	157
Heating, Two-Pipe Steam	88	160
Heating, Unit Systems	87	166
Heating, Warm Air	80	157
Height of Class Rooms	22	20
High School Rooms	46	97
Home-Making	52	103
Home-Making, Curriculum	52	104
Home-Making Room	54	105
Home-Making Equipment	54	105
Humidity	89	170
Incinerators	62	125
Laboratory	48	100
Laboratory, Combination Chemistry and Physical	50	102
Laboratory Equipment	50	101
Lighting Class Room	23	22
Light Area Required	23	23

Digitized by Google

INDEX TO TEXT REFERENCES

Subject	Page	Paragraph
Lighting, Bilateral	23	26
Lighting, Prismatic	24	29
Lighting, Sky-lighting	24	28
Lighting, Unilateral	23	24
Library in Rural Schools	34	55
Library in High Schools	34	56
Library, Location of	35	57
Library, Work Room	35	58
Library, Allowance for Books	35	(A)
Liquefying Chamber for Sewage	68	132
Lockers in Basement	37	62
Lockers in Corridors	37	64
Lockers in Gymnasium	58	114
Lockers, Individual	37	63
Measuring School Buildings, Rules	10	(M)
Motion Pictures	75	151
Painting and Decorating	32	52
Physical Examination Rooms	57	113
Phonographs	77	155
Plans, Approval of School	8	(A)
Play Grounds	15	11
Play Grounds, Size of	13	2
Platforms, Height of	45	94
Prismatic Glass	24	29
Ramps	43	85
Recitation Rooms	48	99
Roofs, Flat	34	54
Roofs and Roofing	33	53
Sand Strainers	61	121
Seating Capacity of Class Rooms	22	21
Sewage Disposal	64	129
Site, Selection of	13	1
Skylighting	24	28
Sludge	65	131
Stage Furniture	45	95
Stairways	42	83
Statistics New York State Schools	7	...
Statistics United States Schools	7	...
Siphon	68	134
Swimming Pools	58	115
Teacher's Private Room	36	59
Teacher's Residence	94	175
Telephone Systems	78	154
Thermostats	89	172
Toilet Accommodation	59	116
Toilet Room Floors	59	117
Toilet Room Plumbing Fixtures	60	Fig. 23
Toilet Facilities	62	126
Toilets in High Schools	62	123
Toilets, Types Approved	63	127
Toilet Room Partitions	62	124
Toilet Room Walls	59	119
Transoms Over Doors	41	79
Treads and Risers	43	84
Treads, Non-Slip	43	84
Trench Filling	68	135
Unit Heating Systems	87	166
Urinals	61	122
Ventilating Systems	85	162
Ventilation by Roof Ventilators	89	171
Vocational Agriculture	72	145
Vocational Equipment	73	147
Vocational Rooms	72	146
Vocational Shop	74	148
Vocational State Aid	75	150

Digitized by Google

INDEX TO TEXT REFERENCES

Subject	Page	Paragraph
Wall-Boards	57	110
Water Closets	61	119
Water Closets, Number Required	60	Fig. 23
Water Supply	69	138
Waterproofing Septic Tank	69	137
Wardrobes	36	60
Wardrobes, Floor Plan	21	Fig. 6
Weatherstripping Doors and Windows	29	42
Weatherstripping, Detail of	25	Fig. 7
Wells	69	139
Wells, Driven	70	140
Window Construction	28	41
Window Details of Construction	25	Fig. 7
Window Glass	28	40
Window Mullions	25	31
Windows, Position of	24	30
Window Shades	27	39
Windows, Steel	28	41

Digitized by Google

Digitized by Google

Digitized by Google

This book may be kept

FOURTEEN DAYS

from last date stamped below. A fine of TWO CENTS will be charged for each day the book is kept over time.

29 MY 28			
200c134			
MAR 23	1937		
JUN 19	1984		
MINITEX - 7043			

89087917449

B89087917449A

Digitized by Google

LaChance IR
.L113
Schoolhouses and
their equipment

EDUCATION LIBRARY

Digitized by Google

b89087917449a

Digitized by Google